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FRESH AIR

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ON one of the hottest of the hot nights of British India, a little more than one hundred and fifty years ago, Siraj-Uddaula, a youthful merciless ruler of Bengal, caused to be confined within a small cell in Fort William, one hundred and forty-six Englishmen whom he had that day captured in a siege of the city of Calcutta. The room was large enough to house comfortably but two persons. Its heavy door was bolted; its walls were pierced by two windows barred with iron, through which little air could enter. The night slowly passed away, and with the advent of the morning death had come to all but a score of the luckless company. A survivor has left an account of horrible happenings within the dungeon, of terrible strugglings of a steaming mass of sentient human bodies for the insufficient air. Within a few minutes after entrance every man was bathed in a wet perspiration and was searching for ways to escape from the stifling heat. Clothing was soon stripped off. Breathing became difficult. There were vain onslaughts on the windows; there were vain efforts to force the door. Thirst grew intolerable, and there were ravings for the water which the guards passed in between the bars, not from feelings of mercy, but only to witness in ghoulish glee the added struggles for impossible relief. Ungovernable confusion and turmoil and riot soon reigned. Men became delirious. If any found sufficient room to fall to the floor, it was only to fall to their death, for they were trampled upon, crushed and buried beneath the fiercely desperate wave of frenzied humanity above. The strongest sought death—some by praying for the hastening of the end; some by heaping insults upon the guards to try to induce them to shoot. But all efforts for relief were in vain, until at last bodily and mental agony was followed by stupor. This tragedy of the Black Hole of Calcutta will

ever remain as the most drastic demonstration in human history of the bondage of man to the air that surrounds him.

What is this thing upon which the life of the body is so dependent? As history goes, it is only comparatively recently that we have learned what air is. "To tell the story of the development of men's ideas regarding the nature of atmospheric air," says Sir William Ramsay, "is in great part to write a history of chemistry and physics." Believed at first to be a single substance, by the middle of the seventeenth century men began seriously to try to learn by means of experiment whether air is not compound. It would take us too far from our immediate subject to wander through the mazes of more than a hundred years of those early efforts, of the rise of the belief that air contains some ingredient that is necessary to both combustion and respiration, of attempts to identify this substance, of the contest between the phlogistic and the antiphlogistic theories, and finally of the rather rapid crystallizing out of the air's constituents. The credit of solving the problem belongs almost wholly to Englishmen. In 1755 Joseph Black isolated carbon dioxide, the first constituent of the air to be definitely recognized. Nitrogen was next to appear, the discovery of Daniel Rutherford in 1772; and two years afterward Joseph Priestley published the first description of oxygen. Here the matter rested for more than a century, when in 1895 Lord Rayleigh and Sir William Ramsay aroused the world by the announcement that they had found in air a new gaseous element in minute quantity, which they proposed to christen argon, the inert. To this Ramsay subsequently added the still more rare helium, krypton, neon and zenon, and he says:

> It would be rash to predict that no other elements still remain to be discovered among its [the air's] constituents; but if there are they must be present in still more infinitesimal amount than the rarer non-active gases.

We may, therefore, doubtless rest content with the thought that the problem of the air's constituents is practically solved and that, when pure, air is simply a mixture of gases, mostly elementary.

Air of ideal purity never exists outside the chemist's test tubes. The gases of atmospheric air are usually present in the following approximate proportions by volume:

	Per Cent.
Oxygen	20.94
Carbon dioxide	0.03
Nitrogen	78.09
Argon	0.94
Helium, krypton, neon, zenon, hydrogen, hydrogen peroxide, ammonia	traces.

As we know it and breathe it, air always contains other constituents derived partly from the inorganic earth, partly from plants and ani-

mals and largely from man and his works. Its oxygen is often diminished in quantity, its carbon dioxide often increased; it always contains the vapor of water in appreciable amounts, traces of nitrous and nitric acids, radio-active constituents, dust and usually bacteria; its composition may be altered by the presence of sea salts, by the respiration of man and other animals and plants, by the combustion of illuminating gas and its products, and by a host of industrial processes. Of these various alterations those produced by the respiration of man is of chief interest to us here. The gases of air as it comes out of man's lungs are present in the following approximate proportions by volume:

	Per Cent.
Oxygen	16.4
Carbon dioxide	4.1
Nitrogen	78.09
Argon	0.94
Helium, krypton, etc	traces.

Of the air's various gaseous constituents, nitrogen, argon and helium and its companions are what the chemists call inert substances, *i. e.*, they are slow and backward about entering into chemical alliances. However important nitrogen is in the life of living things, neither is it, nor are these other inert gases, known to exert as atmospheric components specific actions on living human beings. They may, therefore, be eliminated from consideration, as may also the minute traces of hydrogen and ammonia, and our attention may be focused at once upon oxygen and carbon dioxide.

With oxygen the case is very different from that of nitrogen. A component of all living tissues and a participant in nearly all vital processes, its one great source is the atmosphere, and its entrance into the human body is by way of the lungs in respiration. Without it man would perish; yet his body is so adapted that to sustain life permanently oxygen must be given to him in a certain percentage and under a certain pressure, both percentage and pressure varying within certain limits. Under the ordinary conditions of life the proportion of oxygen in the air that we breathe varies only slightly. Thus the air of the open country and that of the streets of crowded London differ by less than one tenth of one per cent. At the sea-side and on a mountain top 14,000 feet above, the percentage of atmospheric oxygen is practically the same; on the mountain top, however, the pressure of the gas may be less than two thirds of its pressure at the sea-side. Every inexperienced climber has felt the need of a greater pressure of oxygen. Archdeacon Stuck, when led by the indefatigable Karstens to the top of Mt. McKinley, suffered greatly from the rarefied air. Writing in the third person he says:

The writer's shortness of breath became more and more distressing as he rose; all were more affected than at any time before, but none of the others in this acute way. The fits of panting became more frequent and more violent; at such times everything would turn black before his eyes and he would choke and seem unable to recover his breath at all. Yet a few moments' rest recovered him as completely as ever, to struggle on another twenty or thirty paces, and to sink gasping on the snow again. . . . With keen excitement we pushed on. . . . The last man on the rope, in his enthusiasm and excitement somewhat overpassing his narrow wind margin, had almost to be hauled up the few final feet, and lost consciousnes for a moment as he fell upon the floor of the little basin that occupies the summit.

Various experimental researches, and especially the latest and very careful investigation by Haldane, Douglas, Henderson and Schneider on Pike's Peak, have proved beyond a doubt that that formerly mysterious disease, mountain sickness, is due solely to the greatly diminished pressure of oxygen existing at all considerable heights. That wonderful power of adaptation to unusual conditions, however, of which the human body is so generously possessed, is here demonstrated in the fact that on reaching the unusual height the quantity of hemoglobin, which gives the red color to the blood and enables it to carry oxygen to our tissues, begins to increase, and a few days of life at the high altitude renders us capable of continuing to live there under the diminished oxygen pressure without further danger to life.

Within a crowded assembly the proportion of oxygen may fall to one twentieth of its usual amount in the outdoor air, probably never more except in the most extreme experimental conditions. Experimentation has apparently shown that the evil effects of such indoor air are not due in any respect to this slightly lesened quantity of the gas. It has even been diminished to less than seventeen per cent. in experimental chambers without apparent detriment to persons confined therein. Hill says of a group of his students whom he confined in a narrow air-tight room: "We have watched them trying to light a cigarette (to relieve the monotony of the experiment) and puzzled by their matches going out, borrowing others, only in vain. They had not sensed the percentage of the diminution of oxygen, which fell below seventeen." The ventilation of coal mines by air containing only seventeen per cent. of oxygen has indeed been suggested as a preventive of explosions. On the other hand, a "sand hog" working in a caisson at a depth of one hundred feet must be subjected to a pressure of oxygen four times that found in the usual atmosphere. Here he can work for several hours with impunity; a longer time would give an opportunity for the excess of this gas to manifest its toxic action on his tissues. Because of this poisonous action too, a man can breathe pure oxygen when in excess for a limited period only. The administration of oxygen in extreme illnesses thus has its limitations.

Ozone is a form of oxygen in which three, instead of the usual two, atoms are united in the molecule. It is present in minute quantity in the atmosphere, usually not of cities, but of the country and the sea. Its powerful oxidizing properties and its intemperate advocacy by enthusiastic but unscientific persons have caused it to be hailed popularly as highly beneficial to the human body, not only in ordinary respiration, but in the purification of the air of living rooms, the destruction of bacteria and other organic matters, and the cure of disease. On crisp cool mornings we are fain to enlarge our chests as we step into the open, and breathe in deep draughts of this supposedly health-giving gas; to mountain tops and forests we go in search of its renovating properties; and our mail is fat with circulars descriptive of the marvelous benefits of ozone machines, of ozonizers and ozonators. In many offices and homes we find these machines, busily at work discharging into the atmosphere their peculiarly odoriferous product. Very recent investigations, however, seem to make it clear that the supposed beneficial powers of ozone as a home companion are creations of the imagination. Two groups of American investigators, Jordan and Carlson in Chicago and Sawyer, Beckwith and Skolfield, in Berkeley, have independently carried out each a series of careful experiments on the action of ozone on bacteria, animals and human beings. They find that ozone will indeed kill bacteria exposed in a room, but only when in such concentration that it will kill guinea-pigs first.

There is no evidence for supposing that a quantity of ozone that can be tolerated by man has the least germicidal action.

When present in any considerable quantity in the air ozone is irritating and probably corrosive to the lining membrane of the air passages of the nose, throat and lungs, causing the blood-vessels of this membrane to be excessively dilated and to present the customary symptoms of "sore throat." It causes headache and drowsiness. The heart, at first accelerated, is later slowed and weakened, and the pressure of the blood in the arteries is unduly lowered. The case for ozone thus seems to narrow down to a supposed beneficial action in destroying or modifying unpleasant odors in the air of a room. When in not too great concentration such odors are, it is true, overcome, though it is quite probable that their disappearance is due, not to an actual destruction of the odoriferous substance, but partly to a replacement of the disagreeable odor by the odor of ozone and partly to fatigue or anesthesia of the olfactory membrane of the nose. It is very questionable whether this is wise, and Jordan and Carlson well say:

It seems to us that this is wrong in principle, and that ozone is being used and will be used as a crutch to bolster up poor ventilating systems. Ozone does not make pure air any more than strong spices make pure food.

Perhaps the last word has not yet been said on this subject; nevertheless I strongly suspect that ozone does not deserve the reputation which commercial interests are endeavoring to foist upon it and that as a panacea it is destined to follow into oblivion phylacteries and amulets, blue glass and the rabbit's foot.

Carbon dioxide within man's body performs certain useful purposes. Generated in all of his tissues and passed from his cells into the lymph and blood that bathe them, when in not too large quantity it reacts upon the tissues as a hormone, or excitant, to stimulate them to greater activity. It thus for a time, during the earlier stages of a task and before fatigue sets in, augments our working power. One of its most striking services is that of acting as the stimulus to that part of our nervous systems which presides over our respiratory movements. After each expiratory act the accumulating carbon dioxide within our blood excites our respiratory center to a subsequent inspiration, and except for this substance within us respiration would be impossible. But when in larger quantity than is required for these needs carbon dioxide is poisonous to our tissues, causing fatigue and depression of working power, and for the good of the organism must be expelled. It is, therefore, carried to the lungs and passed into the air. Thus much of the carbon dioxide of the atmosphere represents a waste and poisonous product of protoplasmic activities, of no use to man, however valuable it is to the green plants. When breathed in excessive quantity it may cause a feeling of suffocation, headache, nausea and other unpleasant sensations, and may ultimately even be fatal. But the poisonous properties of carbon dioxide have been exaggerated. Thus while normally it is present in free air in only about three hundredths of one per cent., the breathing for hours of more than thirty times this amount does not appear to be detrimental to the individual. In fact it has recently been shown by Crowder that the air immediately before our faces is contaminated with expired carbon dioxide in varying quantities which in extreme cases may reach one per cent. Except where ventilation is very vigorous, as in facing the breeze of an electric fan, we are thus habitually rebreathing a portion of the air which has previously entered our lungs. In the face of such facts the minute variations of carbon dioxide in unconfined air are altogether negligible from the hygienic standpoint. Thus the proportion of this gas is greater in the air of cities than of the country, in night air than in that of day, in fogs than in clear weather, with a low than with a high barometer, at the foot than on the tops of mountains, and inland than at the seaside. But all such differences amount to merely a few thousandths of one per cent. and are probably of no importance whatever in the life of the individual. There is a larger proportion of the gas in the more or less confined air of crowded assemblies, school rooms and industrial work

rooms, but even here it very rarely reaches four tenths of one per cent., or ten times its usual amount, and this is still well below the harmful limit. It thus appears that carbon dioxide, like oxygen, may be eliminated from the problem of fresh air, except under the rarest and most extreme circumstances.

The amount of carbon dioxide present is often regarded as a convenient and proper index of the degree of vitiation of air by human beings, and a limit to this is sometimes established by law for factories where many employees work together. Our country unfortunately has not reached that stage of governmental control of its industries in which legal standards of ventilation are established and maintained. We ought to do this in the interests of the health of the workman, but when we are prepared for it we should select some other index of the air's impurity than the amount of carbon dioxide present in it.

There has long existed a belief—and it has been strengthened by the advocacy of competent men of science—that air that has once been breathed by human beings is poisonous apart from its content in carbon dioxide, and this belief has fixed upon a hypothetical unknown organic constituent, a toxic protein, which is supposed to be produced within the body, volatilized and then cast out with the outgoing breath. Various attempts have been made during the past twenty-five years to support this belief experimentally. The most of such experiments have consisted in condensing expired air, injecting it into animals and obtaining symptoms of intoxication. Notwithstanding their seeming conclusiveness one by one these apparently positive results have been explained on other grounds than as due to the presence of an expired organic poison coming from the lungs and, moreover, they have been offset by more conclusive experiments terminating negatively. The latest of these researches finds no evidence whatever to support the theory of an organic poison, a "crowd poison," as it is sometimes called; and we must believe that the theory represents one of those erroneous conclusions which science frequently draws from incomplete evidence and then proceeds to utilize in discovering the truth.

Another feature of vitiated air is odor. Odor is always due to the existence of material, in the form of either gas or very finely divided solid particles, which has the power of stimulating the delicate terminals of the olfactory nerves in the walls of the nasal passages. Pure air contains nothing that can stimulate these nerve terminals and therefore is wholly free from odor. Odor may be introduced into air through decaying organic matter, through illuminating gas or the products of its combustion, through various foreign substances used in industrial procedures, and through emanations from the human body. These last are many and varied, both in quality and origin, and together they give to the air of a crowded assembly which lacks adequate ventilation the

peculiar unpleasant crowd odor with which all are familiar. Our sense of smell is subjected continuously to slight stimulation, but it is peculiarly and vividly responsive to unpleasant changes in our odorous environment. Thus on entering a crowded, close and stuffy room the odor often seems to us intolerable, and we at once assume that the air is very bad for any one who breathes it. We rush to the window and throw it open, or complain to the janitor, or retreat in disgust. Well, the air may indeed be very bad, but this is not because of its odor, except as to the odor's possible psychic effect. There is a peculiar relation between one's sense of smell and one's esthetic sense, and an unpleasant odor by rudely shocking the esthetic part of our nature may interfere with our efficiency; but there is no evidence in support of the idea that the odoriferous elements in crowd air are physically or chemically harmful to us. Our sense of smell, however it may disturb us, is probably the least valuable of all our senses in contributing to our physical welfare and it can the most readily be dispensed with—a too sensitive nose is really an affliction. This sense is in fact extremely subject to fatigue, and hence on confinement in crowd air our olfactory aversion to it soon ceases—a provision of nature which is not altogether an evil.

Strangely enough it is only within a period of scarcely more than thirty years that the occurrence and the significance of atmospheric dust have become accurately known. Dust has now been shown to exist in air everywhere: in uninhabited as well as inhabited regions, though the more where man and his works are; at the tops of lofty mountains; and over the largest of oceans. The numbers of dust particles found by different observers in a single cubic centimeter of air have varied from 157 at the summit of the Swiss Bieshorn to more than 200,000 in a Parisian garden. On dusty streets and within doors, especially in dusty trades, still more dust may exist, and it is estimated that a single puff of tobacco smoke discharges into the atmosphere 4,000,000,000 particles. Dust may consist of inorganic and lifeless organic matter, as well as bacteria and other living organisms. It may be carried long distances. The most striking known example of this is the fine pumice which was sent into the air to tremendous heights and in enormous quantities at the time of the extraordinary eruption of the East Indian volcano Krakatoa in 1883. This fine dust was carried completely around the earth and from the extreme north to the extreme south of the largest continents. Moreover, it continued to exist for several years as a component of the earth's atmosphere. To dust particles we owe the existence of clouds, fog and haze, the beautiful colors of the sunset, and in large part the blueness of the sky. Dust is thus our constant companion and with every breath we inhale much of it. Our bodies are prepared for this and possess defensive agencies for our protection. With these agencies in proper order the greater part of the ordinary inhaled

dust is harmless. It is not so, however, with the dusts produced abundantly in various trades, such as in the manufacture of cutlery, pottery, porcelain, glass, copper, iron, steel, brass and lead wares, in stone-cutting and cotton manufacture. Some of these industrial dusts are poisonous; some are mechanically irritating to the walls of our air passages. In dusty occupations such diseases as bronchitis, tuberculosis and pneumonia are unduly prevalent, and there is no doubt that their beginnings lie in local injuries to the lungs produced by the inhaled particles and that these injuries are followed by the lodgment of the specific bacteria.

Of the bacteria of the air and their relation to disease I must speak at greater length. From the earliest times the belief has existed that bad air is a prolific source of disease. The word "malaria" literally means "bad air," and the disease malaria was the type of those diseases that were supposed to be spread through the atmosphere. In the early days of the germ theory air was regarded as the chief medium of the transmission of disease germs. As one writer graphically put it, disease is "literally borne on the wings of the wind." The great surgeon Lister accepted this notion and conceived the idea of improving surgical technique by maintaining a continual and very fine spray of carbolic acid in the air in the immediate vicinity of the operation. Thus antiseptic surgery arose. Although surgery has now gone far beyond this stage and no longer regards the air as a source of operative infection, the general notion of aerial infection still prevails. But a multitude of facts, gradually accumulated, show that this notion must be revised. It is true that bacteria may be moved through the air, and this may occur under three conditions: when they are freely floating, when they are attached to particles of dust, and when they are contained within the bodies of flying insects. The dissemination of disease germs by insects is a serious fact—the mysterious miasma of malaria lies only within the body of the mosquito, and malaria is still the type, but in a new sense, of certain diseases that are spread through the atmosphere. But there are many reasons for believing that the danger of infection through germs freely floating in air or attached to particles of dust has been much exaggerated. Living organisms, it is true, may be found in the atmosphere of inhabited localities under almost any circumstances. To capture them it is only necessary to expose to the air for a few moments a sterilized plate covered by a layer of nutrient agar on which the floating particles may fall. If the plate be then covered and transferred to a warm place, the organisms will proceed to multiply and develop colonies. It is then found that they comprise bacteria and some other microscopic forms. By far the greater number are quite harmless, but pathogenic or disease-producing species do occur. These may include germs of tuberculosis, diphtheria, typhoid fever, dysentery,

anthrax and suppuration. The mere fact that such germs have at times been found, however, is of little significance in the matter of possible aerial infection. They never occur in any considerable numbers, and considerable numbers of germs are usually necessary to produce a disease. It is known that many bacteria on being cast out into the air from an infected source lose their virulence in the process of drying and soon die. Evidence that disease germs pass through the air from room to room of a house or from a hospital to its immediate surroundings always breaks down when examined critically. It is indeed not rare now to treat cases of different infectious diseases within the same hospital ward. The one place of possible danger is in the immediate vicinity of a person suffering from a disease affecting the air passages, the mouth, throat or lungs, such as a "cold," or tuberculosis. Such a person may give out the characteristic microbes for a distance of a few feet from his body, not in quiet expiration, for simple expired air is sterile, but attached to droplets that may be expelled in coughing, sneezing or forcible speaking. In this manner infection may, and at times probably does, occur, the evidence being perhaps strongest in the case of tuberculosis. But apart from this source there appears to be little danger of contracting an infectious disease from germs that float to us through the medium of the air—aerial infection in the most of those diseases with which we are familiar is, in the authoritative words of Chapin, "under ordinary conditions of home and hospital a negligible factor." Avoid all forms of physical contact with disease germs or germ-laden articles; keep hands and dishes clean; beware of infected food and water; if you can detect him shun the bacteria-carrier, he who unwittingly carries within his body the germs without the disease and may deposit them where subsequent physical contact is possible; but do not be tormented any longer by the unnecessary specter of germ-laden air.

I might add a few words concerning sewer gas. Sewer gas consists simply of air containing volatile substances which are given off by the decomposing organic matters that occur in sewage. There is nothing mysterious about the components of sewer gas except in the minds of those who stand in dire dread of it. It may contain carbon dioxide, the ill-smelling hydrogen sulphide and ammonium sulphide, marsh gas, ammonia and certain other gaseous substances—all of these in variable, and, with the possible exception of carbon dioxide, usually small amounts. There is no excessively poisonous gas among them. Bacteria exist abundantly in sewage, but these appear to be given off to the air only when the liquid sewage is mechanically splashed and then only in very small numbers and usually not to great distances. Winslow has made a most careful experimental study of this subject, and has come to

the conclusion that "the chance of direct bacterial infection through the air of drains and sewers is so slight as to be practically negligible."

He says:

> If one were to breathe for twenty-four hours the undiluted air of a house drainage system, at any point not immediately infected by mechanical splashing, it appears that less than fifty intestinal bacteria would be taken in. . . . There would be less danger of contracting disease from continuously breathing the air of a vent pipe, except where liquid is actually splashing, than from drinking New York water.

Workmen in sewers are notoriously strong, vigorous, healthy men, with a low death rate among them. With such facts before us the specter of an invisible monster entering our homes surreptitiously from our plumbing pipes and sapping our lives and the lives of our children must be laid aside; we need no longer leave saucers of so-called "chlorides" standing about our floors to neutralize in an impossible manner mysterious effluvia that do not exist; and when we return to our town houses in the autumn we may enter them with no fears that we are risking our lives by coming into a toxic, germ-infected, sewer-gas-laden, deadly atmosphere.

Our consideration so far of the qualities of air and their relation to human beings has been mainly destructive. I have tried to make it clear that we must give up some of our long-cherished notions. We have seen that while air may be rendered unsuitable for respiration by very unusual means, such as the addition of poisonous gases or excessive quantities of irritating dust or bacteria, the vitiation of air by the presence within it of human beings is not due, except under the most rare and exceptional circumstances, to chemical changes produced therein by respiration, such that when the air is rebreathed it reacts harmfully through the blood on the bodily tissues. The claims that are sometimes made by the venders of commercial chemical air-purifiers on behalf of their machines are based upon entire ignorance of the facts.

Nevertheless, that the air of a confined, ill-ventilated room when crowded with human beings soon becomes bad can admit of no question, and we are forced to search further for its bad qualities. Science has in recent years apparently found them in the physical, rather than the chemical action of such air on the body. This conclusion has been reached, not so much through inability to find the evil in other features, as through the very positive results of many experiments made by different investigators.

The human body is constantly burning fuel within itself and producing heat in the process. The amount of heat thus produced during twenty-four hours by an average adult man, when at rest, is about 2,400 calories, which is equal to the heat evolved by four or five ordinary Tungsten electric lamps during the same time. Such a man doing hard

physical work generates more than twice this amount. The heat generated within man's body is not wasted energy; it keeps his bodily tissues at the temperature (37° C.; 98.6° F.) at which nature has decreed that they shall do their best work. But more heat is produced within than is needed for this purpose, and if this excess were allowed to accumulate unchecked, man's tissues would very soon become unduly heated, the protoplasm of his living cells would become coagulated, and death would be the end of him. He possesses, however, a very efficient regulating mechanism by which his body is enabled to give off heat constantly and in quantity just sufficient to maintain an equilibrium, notwithstanding the varying amounts which he produces from minute to minute. This constant output of heat takes place partly through expired air, but chiefly by direct radiation into the air from the skin, by conduction from the skin to the clothing, and by the evaporation of perspiration poured upon the surface of the skin by the sweat glands. The skin is thus the medium by which the excess of the bodily heat is carried away. But the action of the skin is dependent upon the action of the nervous system in regulating both the amount of hot blood sent to it and the activity of the sweat glands. Whenever, therefore, the body works harder than before and produces more heat, not only does the breathing intensify, but through the nervous system the cutaneous blood vessels are dilated, more blood is sent to them, more perspiration is made in the glands, poured out and evaporated, and thus the excess of heat is passed out to the clothing and the air. By these provisions our bodily temperature is kept fairly constant, whether we do much or little work, whether we live indoors or outdoors, in summer or in winter, whether we labor beside molten metal at a temperature of 250° F. or are exposed to the polar air with its 75° F. below zero.

Nevertheless, it is obvious that there are external essentials to this physiological power of regulation and that these are the possibilities of the radiation and the conduction of the heat and the evaporation of the perspiration. The body is ever ready to do its share, but the surrounding air must be in such a physical condition as to supplement the body's activities. If the air be cool and moderately dry the best conditions exist for the body's well-being; if the air be hot and dry, or cool and moist, within certain limits the body can protect itself; but if the air be hot and at the same time contain much moisture a condition exists against which the body is imperfectly equipped. If the external temperature be as high as or higher than the bodily temperature, bodily heat can not be given out by radiation and conduction, and if at the same time the air be saturated with moisture, bodily heat can not be given out by the evaporation of perspiration; and thus with the two principal avenues of heat loss obstructed and with the fires still burning within, the temperature rises and the unfortunate individual passes

into a fever. This fever is accompanied by abnormal chemical changes within his tissues and the production of toxic substances, which in turn react upon his tissues diminishing their working power, inducing early fatigue, and upsetting the normal equilibrium of his organs. The result of such a disturbance of his bodily mechanism, if very pronounced, is the production of a pathological condition which is called heat stroke.

But the extreme condition of air at a temperature above the bodily temperature and completely saturated is not necessary for inducing the pathological symptoms. We may witness them under somewhat more moderate conditions in the frequent cases of sunstroke which occur in the streets of our American cities on hot and humid days. The observations of Rubner, one of the foremost German hygienists, indicate that even at 75° F., or more than 23 degrees below bodily temperature and with a humidity of only 80 per cent. of saturation an untrained man can continue comfortable only by refraining from physical work. The performance of work under these conditions would throw a tax upon his powers of adaptation. Even at still lower degrees of temperature and humidity the unfavorable symptoms may begin to appear. indeed the point at which our environing air ceases to be comfortable and begins to force us to make special efforts at accommodation to it is one that is not outside our range of frequent experience.

Many experiments, some of them striking, seem to make it clear that it is to these two features of heat and humidity, the same features which are responsible for sunstroke, and not to others, that all the evil effects of the air of crowded, ill-ventilated rooms are actually due. These experiments have usually consisted in confining and observing men, perhaps several together, in comparatively small experimental chambers. Sometimes these chambers have been little more than bare boxes; sometimes they have been rooms provided with elaborate devices for varying the quantity and qualities of the air. Sometimes the subjects of the experiments have been obliged to breathe over and over again the same air; sometimes the air has been kept under careful control and changed in various ways. The effects of the various conditions have then been observed and recorded. These observations upon human beings have been supplemented by a variety of experiments on animals, and these animal experiments have added greatly to our knowledge of the qualities of the air which human beings ought to breathe.

One of the notable and fruitful investigations was an American one, carried on between 1893 and 1895 by Billings, Mitchell and Bergey with the aid of the Smithsonian Institution in Washington. The Billings of this investigation was the efficient organizer and first librarian of the New York Public Library and the Mitchell was our famous physician-author, Dr. Weir Mitchell. Another helpful American contribution is that of Benedict, whose work with the respiration calorim-

eter at Wesleyan University was so prophetic of worthy contributions to science that he was chosen to organize and direct the work of the Nutrition Laboratory of the Carnegie Institution, which is situated in Boston. The Germans, as ever, have also been leaders in this experimental work, an important contribution having come from the laboratory of Professor Flügge of Breslau. The English have been and are still contributing some of the most significant facts, especially a group of men led by Dr. Haldane of the University of Oxford. The work of Dr. Leonard Hill of London has become widely known through the public prints. The eminence of these various men is indicative of the interest which the homely subject of fresh air can arouse in us.

Several of the investigators have placed men within small closed experimental chambers, arranged with tubes passing through the walls to the outside air, so that the subjects within can at will rebreathe the hot, close, confined air or take in the fresh air from outside. Under such conditions it is found that confinement within and breathing of the unventilated air soon brings on the usual symptoms. If the subjects then breathe through the tube the fresh cool air from outside they obtain no relief. If they step outside relief comes instantly. If, on the other hand, a person standing in the fresh air outside breathes through the tube the stale air of the chamber, which has been breathed over and over again by the subjects within, the unpleasant symptoms do not appear; if he steps inside, they begin to appear at once. If with subjects within feeling the ill symptoms electric fans be started and the stale air be vigorously stirred, thus driving the hottest air away from the skin, relief comes at once. These fundamental experiments have been performed in varied ways, and have been supplemented by many others. Their results have accorded well with one another and allow but one general conclusion, namely, that the evil effects exerted upon human beings by air that has become vitiated by human beings result not from a lack of oxygen, not from an increase of carbon dioxide, not from the presence of an organic poison, not from any chemical features of such air acting through the lungs on the tissues, not in any manner from the rebreathing of such air, but solely from the physical features of excessive heat and excessive humidity interfering with the proper action of the skin in regulating bodily temperature. The problem of bad air has thus ceased to be chemical and pulmonary, and has become physical and cutaneous.

With this knowledge before us it is clear that in the ventilation of the future attention should be focused less upon the chemical purity of air, although of course there are ultimate limits to chemical purity, and more upon the maintenance of a physiologically proper temperature and humidity. What here constitutes physiological propriety varies with individuals, with age, with clothing, with occupations and with

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habit. Undoubtedly our American houses during the winter months are usually kept too hot to maintain the highest efficiency of the individual. We are in far better physical condition when surrounded by a house temperature of 65° to 68° F. than of 70° F. Some of the British authorities advise a house temperature as low as even 60° F. Young persons can live efficiently in a lower temperature than those of middle life, while aged persons require warmer air. A lower temperature is better where physical work is being done. The following temperatures of heated rooms are recommended by American ventilating engineers:

Occupants at Rest	Degrees F.	Occupants Physically Active	Degrees F.
Living rooms, offices, schools	68	Gymnasiums	60
Lecture halls	61–64	Work shops, moderate exertion	61–64
Sleeping rooms	54–59	Work shops, vigorous exertion	50–59
Bath rooms	68–72		

As to humidity, a percentage of 60 with air of 68° F. is rational. But the amount of moisture that air is capable of absorbing varies greatly with the temperature, hence it is impossible to establish a single standard of humidity that can apply to a range of temperatures. The surest single index of the physiological quality of the atmosphere at any moment is the reading of the wet-bulb thermometer. In this thermometer the bulb is covered by thin muslin or silk soaked with pure water. The evaporation of the water cools the bulb. The position of the mercury in such an instrument depends on two factors: first, the temperature of the air; and secondly, the amount of evaporation of the water immediately surrounding the bulb, which in turn varies inversely with the amount of moisture in the air generally—the more moisture in the air the less evaporation from the bulb. The wet-bulb thermometer is thus an index, at once, of both temperature and humidity. The most efficient simple instrument for the determination of humidity is the combination of dry bulb and wet bulb thermometers known as the sling psychrometer, but a fairly satisfactory indicator for household use is the instrument sold commercially under the name of hygrodeik. For our living rooms a wet-bulb reading of 60° F. is favorable to the maintenance of a comfortable and efficient physiological state. We can usually keep the temperatures of our rooms within reasonable limits by the aid of our heating systems and air admitted through windows; but the humidity can not be so perfectly controlled without more elaborate means than most private houses are provided with. With the increase in size of our American buildings, whether apartment houses, office buildings, school houses or factories, the provision of ventilation by means of more or less elaborate apparatus has become a necessity, and the profession of heating and ventilating engineer has become one of dignity and importance.

If I were to add to this lecture a paragraph of practical hints, I would say, first of all, keep your houses and offices cool, never above and usually well below 70° F. Unfortunately here a difference between men and women sometimes causes trouble. Woman possesses a perpetual blanket of adipose tissue between her skin and her muscles, which is usually less developed in man, and hence women can dress more thinly than men, and are usually comfortable at a lower temperature. I have seen more than one happy home in danger of wrecking from this unfortunate difference. As a married man I am tempted to plead for greater charity on the part of wives; as a physiologist I realize that a lower temperature is more healthful. Keep room air in motion. An electric fan or a current of air from a window is a great aid in keeping down one's bodily temperature, and preventing sleepiness and bodily discomfort from stagnant air; with electric fans in use there would be fewer naps in churches and lecture halls. Air in motion promotes efficiency. Accustom yourselves to draughts, and especially big draughts. A small blast of cold air directed against a small area of warm skin may do harm, but the larger the current the more the harm gives way to benefit. Air of constantly uniform temperature is monotonous and debilitating. An occasional and considerable cooling, a flushing of the room by a sudden large inrush of outside air is, like a cold bath, stimulating. Do not be afraid of opening the windows of sleeping rooms at night. The prejudice against night air, which arose naturally enough from the belief in the existence of nocturnal disease-bearing miasms, in the light of present knowledge is a foolish prejudice and must give way to the rationalism of scientific fact. The increasing employment of cool outdoor air both night and day as a therapeutic agent in the treatment of disease is based on scientific principles and is justified by its results. And, finally, the whole moral of the modern physiological doctrine of fresh air may be expressed tersely in the two short words, keep cool.

I have thus endeavored to present to you a fair picture of the present attitude of science toward the problem of fresh air and its relation to health. Such a consideration affords an unusually fruitful opportunity to witness the ways in which science progresses, forming hypotheses, testing them and then retaining, rejecting or refining them, as the evidence derived from observation and experiment warrants. Of the subject before us there are still many gaps in our knowledge, and these gaps must be filled. Present knowledge is never final, and our present ideas of what constitutes fresh air may yet require revision. There has recently been brought together in the City of New York under the influence of the Association for Improving the Condition of the Poor and with governmental recognition a group of representative men of science

constituting the New York State Commission on Ventilation. These men are keenly alive to the many interests involved in the general problem of air in its human relations and are now beginning in this city an extended experimental investigation of them in the hope of obtaining results of value to both science and humanity. The man of science who thus successfully investigates feels the keen and satisfying joy of pushing back a little farther the barriers between the known and the unknown; and the multitude who look on reap a benefit from his labor in seeing pointed out a way to more healthful living.

NATURE-PLAY

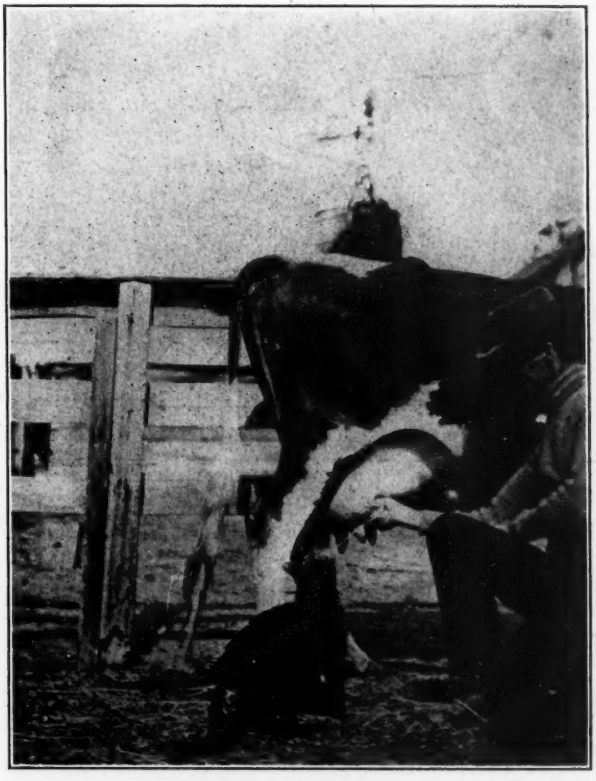
By CHARLES LINCOLN EDWARDS, Ph.D.
DIRECTOR OF NATURE-STUDY, LOS ANGELES CITY SCHOOLS

CHILDREN have a natural interest in all things that are alive, and especially in such comrades as the dog and cat. The nature-study that does not appeal to this interest is worthless. Without formal lessons and examinations and stimulated only by the spirit of play, the child may get an understanding of the other animals that live in the world about him. This is a recreation subject, with the world for its playground; wherein a deep-lying sympathy, bred through the ancestral ages of growth near to the heart of nature, shall lead the child into the joy of living and the happiness of love and knowledge. Nature-play, rather than nature-study, is the key to this wonderful fairyland, of which the child is a part.

In the elementary schools, there should be the freedom to teach and the freedom to learn which have always distinguished the universities of Germany. The mechanical prescription of certain conventionally accepted studies for all pupils, without regard to their individual natures, should be replaced by courses adapted to the constitution and needs of each mind. The individuality of the human being must be recognized and respected in the grammar-school grades as well as in the kindergarten, high school, college and university. The teaching of all subjects by the one teacher in the primary grades should give place to leadership by specialists, as it has already in the secondary schools and colleges. The success of such departmental instruction in many schools justifies its universal adoption.

As in the Heimatkunde of the German schools, a knowledge of nature begins with the investigation of the geography and natural history of the home and its neighborhood. Every child, when led by curiosity and interest, is an investigator, and the discoveries made constitute the most important part of his education. Through open eyes the child should see the common things about him; and then through imagination he may visit distant lands. The domestic cat is quite as interesting and important as the Siberian tiger. At first, the child thinks he knows all about his common playmate, the cat; and yet, he is ignorant of the most significant fact: of the relationship of the cat to himself and other animals. By the simple process of feeling the top of his head, and looking at the back of his hand, he is brought to realize that he, as well as his cousin the cat, belongs to the fur-bearing animals. He learns that the cat walks about on two hands and two feet, and does

not have four feet, as he has hitherto believed. In addition, the cat, like himself, has two eyes, one nose, one mouth, two ears, a heart, lungs, stomach, and, in all respects, is built very much like a human being. After fellowship in play, the child becomes conscious of the most important fact of all: that the cat is intelligent and, in addition to feelings and instinctive actions, has a sense of humor, malevolent and affectionate emotions, thinks and reasons, not indeed with a human mind but with a cat mind. After this, the boy is not so apt to throw a stone at the cat, for he may hit his cousin. He now begins to distinguish the



THREE COUSINS.

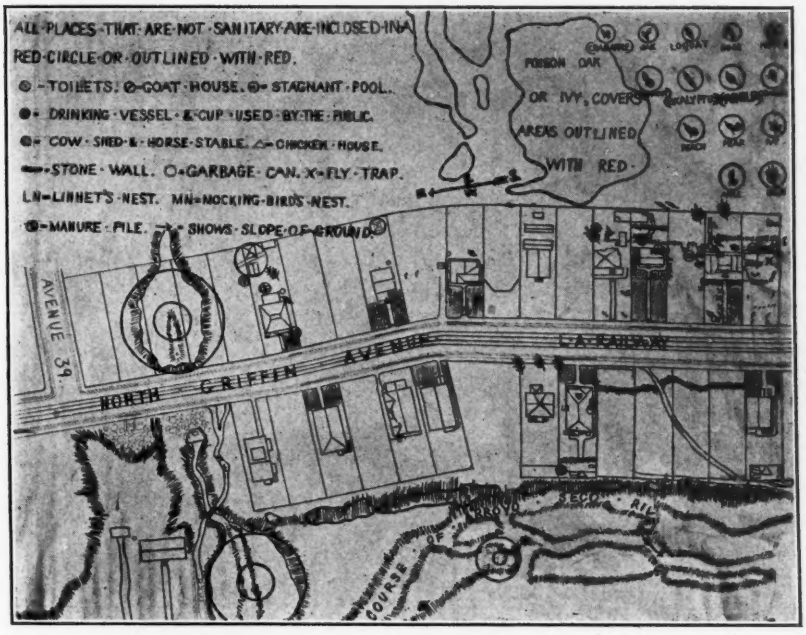
animals who are his friends, to be loved and protected, from those like the fly, who are his enemies, to be eliminated. While learning to love nature, the child should not be influenced by a sickly sentimentality, which prefers to allow flies to live rather than the little babies whom these dangerous animals infect with disease germs.

In our nature-play, one type of animal, or plant, or a few closely related forms, is taken for each week. The course comprehends more than the interpretation of the structure and behavior of the isolated types. The relationship to one another, and to the child, of these living

CHILDREN PLAYING WITH DOGS.

things, is of the greatest consequence. The underlying philosophic basis of comparative anatomy and physiology is kept in mind in the selection of the series of types. There is a necessary dependence upon the season for the observation of many of the plants and animals examined; yet the course should never lose its general theme and become a desultory consideration of unrelated forms. Always freeing the descriptions from unnecessary technicalities and Latin names, the more notable facts are presented in such form, that all children may comprehend them. In the

OBSERVATION AT THE LIVE-BOX.


ALL PLACES THAT ARE NOT SANITARY ARE INCLOSED IN A
RED CIRCLE OR OUTLINED WITH RED.
T - TOILETS. C - GOAT HOUSE. S - STAGNANT POOL.
D - DRINKING VESSEL & CUP USED BY THE PUBLIC.
B - COW SHED & HORSE STABLE. H - CHICKEN HOUSE.
STONE WALL. G - GARBAGE CAN. X - FLY TRAP.
LN - LINNET'S NEST. MN - MOCKING BIRDS NEST.
M - MANURE PILE. → SHOWS SLOPE OF GROUND
POISON OAK
OR IVY, COVERS
AREAS OUTLINED
WITH RED
AVENUE 39.
NORTH GRIFFIN AVENUE
EASTERLY
COURSE OF

SANITATION MAP BY ALBERT KING, SIXTH GRADE, AWARDED FIRST PLACE IN THE WOMAN'S BULLETIN COMPETITION OF 1913, LOS ANGELES CITY SCHOOLS.

beginning the familiar domestic animals are taken; in order that nature-play, started in the school-room, may be continued after school, about the home. A new interest is aroused in the cat, dog, chickens, horse and cow, in the fly and ant, as, led by the teacher's suggestions, the child investigates and is thrilled with new discoveries. Then the pupil is prepared to learn of the less accessible creatures of woodland and sea-side.

When the school program prevents excursions into the field, to parks and museums, the part of nature being investigated must be brought into the school-room. Animals, like the cat, rabbit, chicken, lizard, toad, insects and many others, may be kept in live-boxes, one of which should be provided for each school-room. The best of these live-boxes, or cages, are those planned and constructed by the children themselves. In such efforts, a cooperation with the manual-training department is desirable. By the insertion of a screened door and windows, any dry-goods box may be transformed into the temporary home for the visiting animal. Elaborate and expensive apparatus is not necessary. A glass preserving jar makes a good aquarium for fish or tadpoles. Just as in any other play, children may be relied upon to invent and build the simple things needed.

Never tell children that which they may find out for themselves. Let them count the fingers on the hand of the cat, and then the toes. Have the children watch the activities of the ant nest and then tell the

story of their observations in the school-room and at home. In this way the child develops initiative, resourcefulness and the power of expression, while others share in his interesting knowledge and discoveries. The child himself and his development is the chief aim of nature-play.

At least ten minutes each day should be given to the type under consideration, with an appropriate subdivision of the subject matter for the week. There is no need of different subjects for the various grades. There is not a first-grade cat, second-grade cat, and so on; but only the one cat which should be described in such clear and simple language as to be readily understood by pupils of all ages. Each teacher may be trusted to make whatever translation, or omission, if any, may be necessary for her own pupils. Both teachers and pupils should freely ask questions of one another. If no one knows the answer, let all together become searchers for truth. The crime is not to be ignorant, but to pretend to knowledge when ignorant. With the same type in all the grades, children of different ages in the same family, or neighborhood, and their parents, as well, may all join together in nature-play and thus the larger part of the population will be devoted to learning all about the type in hand. Thus movements for civic betterment, such as the campaign against the fly, may be organized and promoted with power and efficiency.

As a record of individual observations, nature maps may be made of much value and at the same time give an inspiring opportunity for practise in drawing. On a large sheet of paper, the pupil lays out his home square, bounded by streets and subdivided into lots. Houses, stables, trees, bushes, cats, dogs, rabbits, horses, cows, chickens and other birds, lizards, toads, ants and other insects—indeed all the works of nature and of man that it is possible to include—are drawn in, or indicated by appropriate symbols. The sanitation map is a modification, showing

PHOTOGRAPH BY HERBERT MOONEY, FIFTH GRADE, AWARDED THE FIRST PLACE IN THE FIRST ANNUAL NATURE-STUDY EXHIBITION OF THE LOS ANGELES CITY SCHOOLS.

PRIZE POSTER BY ALBERT KING, SIXTH GRADE, IN THE NATURE-STUDY ANTI-FLY CAMPAIGN, LOS ANGELES CITY SCHOOLS.

all unsanitary conditions such as piles of stable manure and other filth where flies breed, and stagnant pools harboring mosquito larvæ. An accompanying explanation indicates the remedial work to be done in order to make the region a sanitary place of residence.

The nature map may be made the basis for a knowledge of economics, by showing: (1) the gardens and the value of their products; (2) the utility of common garden animals—like the toad, lizard, and spider—who eat destructive insects; (3) the proper development of the unused ground.

At the general annual exhibition of nature-play, prizes are offered for the best nature map, poster, drawing and photograph, and this recognition of their work encourages the pupils to sketch and photograph from nature.

The collecting instinct of children should be stimulated and directed toward the gathering of insects, rather than birds' eggs, of feathers, flowers, leaves, rocks, soils and other objects which do not rob nature of things beneficial to man. In this manner, each school-room may build up a useful museum of natural history. To promote the zeal of the young naturalists a nature club is organized in each school. A congress of these clubs is held every month, when the Director gives an illustrated lecture upon some topic of current interest. Agassiz's advice, to "study nature, not books," is important above all things, and yet it must be recognized that a knowledge of the records of the observations and investigations of others makes it possible to see and understand nature more clearly. It is useful to have a library in each room, with books and pictures concerning natural history.

The chief thing is to bring the child in contact with nature, and to give him the pleasure and stimulus of original discovery. It is desirable to have excursions into the yard, garden, field and forest whenever possible. While the class may not visit other countries and thus become familiar with foreign animals and plants in their native environment, yet good zoological parks and botanical gardens offer an excellent, although limited, substitute. After learning of the cat, at school and at home, the pupil may profitably see the large cats, like the lion and tiger, in the zoo, or in the wandering menageries. Almost every child has been to the circus and experienced one of the best possible nature excursions. The giraffe, camel and elephant have been so carefully observed that the pupils are able to sketch them. The child should learn why the giraffe has a long neck and spots on his brown fur, how the camel stores up food in his humps and water in the sacs around his first two stomachs, of the varied uses of the remarkable trunk of the elephant and of the animal's high intelligence.

In order to thoroughly understand things that live to-day, the history of the transformation of their race upon the earth must be followed.

EXCAVATING IN A RANCHO LA BREA FOSSIL BED. At a depth of ten feet, a nest of bones yielded the remains of a bison, two lions, a wolf, horse and other animals. Photographed by L. E. Wyman, through the courtesy of Frank S. Daggett, Director, Museum of History, Science and Art.

The child, learning that the horse walks on the tips of the middle fingers and the middle toes, becomes fascinated with the story of the evolution of this animal, through thousands of generations, from a small mammal about the size of a dog, which had five fingers on each hand and five toes on each foot.

In our excursions to the asphalt fossil beds of Rancho La Brea, down

in the pits the pupils see the embedded skulls and teeth of the imperial elephant and of mastodons, and the bones of saber-toothed tigers, lions, wolves, sloths, giant oxen, camels, and many birds. Here too, beside the trunk of a large cypress tree, a human skeleton has just been found, its bones intermingled with those of the giants of the past. It is not yet determined whether this rare discovery will antedate the earliest remains of man previously recorded. We may then more vividly realize how these strange creatures roamed over our mesa several hundred thousand years ago. These bones have been as perfectly preserved by the infiltrated tar, as if from animals only recently dead; and in the county museum we observe with delight the rare collection of their mounted skeletons. Frequently some bird, deceived by the brightly reflecting surface of a tar pool, alights and is drawn to death and burial in the sticky tar, thus repeating the story of the ages.

Another story from this wonderland of ancient days is added in that of the gigantic reptiles of the past, like the thunder lizard, twice as long as the school-room and so tall that its back-bone would go through the ceiling. The toothless hen, with arms as wings, adapted to flight, a rudimentary free thumb, and the other fingers fused into one piece, has descended from the first bird, with many teeth, three free clawed fingers and a long lizard-like tail having a row of feathers on either side. The ancestor of the first bird was a reptile with five fingers on each hand and five toes on each foot.

LOOKING DOWN INTO A RANCHO LA BREA ASPHALT PIT, TO A DEPTH OF TEN FEET. To the left; skull, femur and jaws of the imperial elephant. To the right; below, femur and teeth of mastodon and femur of giant ground sloth; above, tar seepage through side wall. Photographed by L. E. Wyman, through the courtesy of Frank S. Daggett, Director, Museum of History, Science and Art.

FOSSILS IN RANCHO LA BREA DIGGINGS, SHOWING RICHNESS OF DEPOSIT. Copyright 1909 by J. Z. Gilbert and F. C. Winter and reproduced by their permission.

The history of the modification of some of the earlier water dwellers for life on dry land is illustrated in the development of the tadpole into the toad. The vegetarian tadpole, breathing air dissolved in the water, gradually absorbs its gills and propeller tail and sprouts arms and legs, in order that as a carnivorous toad it may hop about on land and breathe through its newly acquired lungs.

Many living things are useful to man and many are apparently useless, many are beneficial, and many harmful, and yet a knowledge of all nature is to be desired. Pasteur, in his earlier studies of wild yeasts, did not dream that ultimately his work would lead to saving the silk and wine industries of France and reducing the mortality from hydrophobia to less than one per cent.

The child learns that germs are not bugs, nor worms, nor little devils, but that they are very minute plants. When one says he does not believe in germs, he should also say that he does not believe in mushrooms; for both are related plants, the main difference being one of size. It is vital to know that while some germs produce disease, others are the best friends of man. The surface of the earth would be piled sky high with the dead bodies of plants and animals, if not for the putrefactive germs which produce all decay. The green plants, and in the end the animals, too, would starve, if not for certain soil bacteria which fix the nitrogen of the air in the form of the simple food necessary for plants. To germs must be given the credit for the delectable flavors of butter and cheese,

and of assisting, if not being absolutely essential, in the processes of digestion.

To develop narrative skill we have introduced a game called caravan. Beginning in one of the rooms of the upper grade, the teacher selects three pupils especially interested in nature-play, each to describe some animal from the course. The name of the creature is not to be given by the narrator, but must be guessed by the others. Contrary to most guessing games, the object is to have given such a lucid description that the name of the animal will be guessed very soon. Then every one is invited to add anything not mentioned, or to correct any misstatements; so that the descriptions may become the general contribution of the room. By a majority vote the animal is selected to represent the room in the caravan, and then in a similar manner the pupil who can best describe the selected animal. Thus, the caravan starts on its way, in each room, adding a new animal after those already in the caravan have been described. The game proves an admirable review, in which each participating mind is keenly stimulated by the spirit of competitive play.

When man first became superior to the other animals he used weapons to kill them with. The vestige of that primitive struggle for existence is found now in hunting, sometimes necessary for the supply of food, but generally indulged in as a "sport." One summer day,

A Ground Owl that Mistook a Rancho La Brea Pool of Tar for Water. Vegetation on bank reflected in pool. Copyright 1909 by J. Z. Gilbert and F. C. Winter and reproduced by their permission.

A Nature Club Collecting Insects.

beneath the pines at the Alpine Tavern on Mount Lowe, the gray squirrels came to eat nuts from my hand. They had learned to love and trust men. A few months later a hunter approached the boundary of the reservation. The squirrels saw man, their friend, and ran toward him,

Collecting in the Pools.

happy in the expected reward, only to receive shot instead of nuts and to fall dead at the hunter's feet. Another day, near the foot of the western cliffs of San Clemente Island, a great dead sea-lion was floating on a mass of kelp. The Japanese fisherman said that, the day before, sportsmen had shot the sea-lion for the "fun of it." The call of the wild is a tempting voice, leading men back to nature. May the day come soon when many will respond to that call, but with the substitution of camera for gun, yielding better sport and in the end saving our fast vanishing native animals. Just as condemnable as killing animals for sport is the fashion which demands the slaughter of birds for their feathers. The story is familiar of how the beautiful plumes are taken from nesting egrets, and thus the millinery hunters not only kill the

CHILDREN AT THE TIDE-POOL.

parents in large numbers, but also leave the young birds to starve in the nest. Women who do not desire to share in such wanton destruction of bird life will adorn their hats with feathers from the ostrich and other domesticated birds, or with artificial flowers and ribbons.

The poetic insight is necessary for creative work in science as well as in literature. This gift enabled Darwin to construct a philosophy of nature, and Browning to portray the human heart, while in Goethe it was common source of inspiration for naturalist and poet. The imagination of the child should be cultivated, not suppressed. He should hear voices singing in the winds and hold communion with the dryad of the whispering woods and the Naiad of the babbling brook. The stories and songs of negroes and Indians, as gathered in books of folk-lore, con-

SEASIDE COLLECTING.

stitute a helpful adjunct to nature-play. These more primitive people are but grown up children, living in that closer touch with nature often forbidden the dwellers in brick apartments. The beginnings of romance are found in the thrilling adventures of "Brer Rabbit" and the contest of "B'Helephant and B'Vw'ale." Such mythical tales as "Why the Bat is Blind" and "How the Animals Secured Fire" are among the first fanciful attempts to account for natural phenomena. Boys and girls are at home with the ant people, while these intelligent and industrious creatures transport and care for their young, hunt their enemies, cultivate their aphid herds, or fill their subterranean granaries with the seeds which the workers have harvested. We shall not deny mind in the ants simply because they do not perceive and think just as we do. It is quite as efficacious to touch and smell at the same time, through antennal end-organs, as to have these functions separately performed through fingers

CHILDREN ON THE ROCKS AT LOW TIDE.

and nose; and it is also just as well to hear through the vibrations of the earth as through those of the air. Because ants remember odors, they are able to distinguish between friends and enemies, and the observant child may learn that the ant people get angry, at times are afraid, dislike some things and are fond of others, and show sadness and joy, hatred and love.

One of the principal elements in human happiness is the realization of beauty in nature, whether it be in the exquisite form and color of the petal of a rose, the glowing green of the beetle's armor, the flight of the swallow, the moonlight serenade of the mocking bird, the iridescent green and bronze ocelli of the peacock's tail-coverts, the mountains veiled in opalescent mists, the abysmal blue of the ocean, the glory of red and gold in the sunset, or the shimmer of the myriad stars. There is a beauty of structure and function, as in the system of lenses which focus upon the retina the countless rays of light from objects near and far, and thus make possible the mental perception of beauty in nature.

Consider the adaptation for dispersal shown in the dandelion, when the baby plant, in the seed, surrounded by food and borne aloft by a delicately tufted aeroplane, floats far away from its mother. Somewhere —if it fall on fertile soil—when the weather is propitious, the baby dandelion will awaken, sprout as a seedling, mature into parenthood and in turn provide food and aeroplanes for its children.

Nature-play is the true basis for all knowledge. Through this dominant interest the child is led to know of the living things about him. Not merely are the facts of nature important, but much more valuable is the fascinating story of how and why these facts came to be. It is of much import to learn that the animals which bear scales and those covered with feathers, or fur, are all wearing similar clothing, but of the different fashions best suited to their needs. It is still more significant to realize that fundamentally the minds of all animals are as allied as are their digestive and respiratory systems. The great end of nature-play for the child is not simply to learn of the rest of nature, but better to know himself as a part of nature.

RECENT DEVELOPMENTS IN WEIGHTS AND MEASURES IN THE UNITED STATES

By LOUIS A. FISCHER
BUREAU OF STANDARDS

DOUBTLESS many of the readers have noticed in the newspapers and magazines during the past few years articles on false weights and measures and their effect upon the high cost of living; and have wondered why false weights and measures should exist. A more intimate knowledge of the subject will, it is believed, increase that wonder rather than diminish it, for does not the government maintain standards of weights and measures and do not the statute books of the states contain laws purporting to enforce their use? While almost any one will admit the necessity and the importance of regulation if his attention is called to the matter, it is a singular fact that it is only recently that any general interest has been manifested in the subject, or that there has been any organized movement to improve and enforce the laws in regard to weights and measures.

The founders of our government evidently realized the necessity of uniform standards or they would hardly have provided for it in the Constitution in the same clause that gives Congress the power to coin money and to regulate the value thereof. Under that authority the government coins all money, and enforces the severest penalties for counterfeiting. On the other hand, it has enacted practically no weights and measures legislation, but has left the question entirely to the states.

Even the pound, yard, gallon and bushel in common use have never been adopted by Congress, but owe their use to the fact that the government uses them in the collection of revenue and to the fact that they have voluntarily been adopted by the states.

Shortly after the establishment of the Bureau of Standards, complaints began to be received from individuals who felt that they were not receiving all that they were entitled to, and inquiring what they could do about it. There being no federal laws, the bureau could only advise them to look to their state or local authorities for assistance, although it was well known that none of the states at that time had an adequate system of inspection. It soon became evident that the states would not act of their volition, and equally evident that Congress felt no responsibility in the matter. The complaints were scattered, and those suffering were unorganized and consequently without influence. The railroads, corporations and organized industries, like the grain industry, were able to establish and maintain their own weighing or

inspection department, but the individual of the middle or poorer classes had to take what was offered to him or else go to court with every prospect that he would lose his case on some technicality.

In 1902 the writer visited several of the larger cities in the State of New York for the purpose of ascertaining how efficient the inspection service was. The results were discouraging: in most places the inspectors were paid by fees for sealing the apparatus and, consequently, they were only interested in sealing the apparatus for which they could collect fees. They cared very little whether the apparatus was correct when examined, and still less whether it was properly used afterwards. New York City had ten sealers, at $1,200 each, and ten inspectors, at $1,500, under the city clerk, but most of them did little else except draw their salaries. The writer called upon one of them about ten o'clock in the morning and found him still in bed. His young child was playing with his standard weights, which he quickly took away from him when the object of the visit was explained. He frankly admitted that he owed his appointment to his political activity and that little or no services were expected of him.

The situation in New York was no worse than in other sections of the country, as we afterwards found out; it was merely typical of the conditions that existed throughout the country at that time. A couple of years later, or in 1904, the bureau conceived the plan of inviting those officers in the states who were by law charged with the custody of the state standards, to meet in Washington to study the weights and measures situation, and to ascertain what steps should be taken to insure some measure of protection to the public. The first meeting took place in January, 1905, and was, it is believed, the first meeting ever held in this country for the purpose of considering this subject. Pennsylvania, Michigan, Kentucky, New Hampshire, Vermont, Massachusetts, Virginia, Iowa—in all eight states—and the District of Columbia sent delegates. The governors of many of the other states showed interest in the matter, but stated that on account of the lack of available funds from which the expenses of the delegates could be defrayed it would be impossible to have their states represented. Nevertheless, the delegates who did attend were greatly interested in the subject and requested the bureau to arrange for similar meetings annually. Many of them did not know that they had any laws to enforce or any standards to take care of until their attention was directed to the state laws on the subject by the bureau.

Meetings have been held every year since, but the number of states represented never exceeded seventeen until 1912, when 25 states and 34 of the most important cities, including the District of Columbia, were represented. What the earlier conferences lacked in numbers, however, they made up in enthusiasm. By conferring with one another, and by discussion, the delegates learned what was needed, and

in a large majority of cases they went home and attempted and in many cases succeeded in interesting their states in the subject. To aid in understanding the situation, the bureau compiled all the state and national laws on the subject of weights and measures, and also made a report on the laws and regulations governing this matter in the more important European countries. The third conference, in 1907, adopted what was termed a "Model State Law" based both upon existing state laws and the laws of other countries. This "Model Law" has since been improved and its provisions have to a large extent been incorporated in recent laws enacted by the states.

While the conferences were an invaluable aid to what had now become a real movement to bring about more uniform and efficient laws, and while much valuable information was obtained from the delegates, as to the conditions in their states, the need of first-hand information on the conditions throughout the country was felt, and an appropriation of $10,000 was asked for and granted by Congress for the year 1908–09, for the purpose of making such an investigation. The same amount was granted for the succeeding year, and every state in the Union was visited.

The first investigations were made in cities near Washington, in order that if any unexpected difficulties should arise communication with the Bureau would be easy. The inspectors were provided with portable outfits, and made such inspections of the weighing and measuring apparatus as were ordinarily made by the local sealer. That is, they would go into a store, examine the scales, weights and measures, and weigh such packages as were found ready for delivery. At first both inspectors worked together in order to standardize their methods as far as possible; but later they traveled independently of one another and met only at intervals of two or three months when their paths happened to cross or when they were ordered back to Washington for consultation. In order to get at the actual existing conditions, we attempted to complete the investigation in any city before calling on the local sealer, where there were such, and in a few instances this was misunderstood and resented. It was the desire of the bureau to assist and cooperate with the local sealers, but it was obvious that the results found might have been greatly affected by the knowledge upon their part that a government inspector was in town. In most instances, however, the local sealers were glad to see the inspectors and assisted them in every way to get the information they were after. It ought to be said that the cordiality with which they were received was directly proportional to the efficiency of the sealers. To such as were efficient, our reports and cooperations were of the greatest aid in getting additional help and facilities, as well as in having their ordinances improved. And in other cases where there was no inspection or where the service was poor, the reports were the means of bringing the situation to the

attention of the officials and of the people, which frequently resulted in the establishing of inspection departments or of improving the one already existing. In consequence of this activity the Bureau of Standards received many requests from city officials and others for assistance in bettering conditions. To assist in meeting these demands the bureau prepared a model city ordinance on weights and measures, and gave advice regarding suitable standards and apparatus, and on other important matters.

Altogether, 184 cities or towns were inspected, ranging in size from New York with four or five millions of inhabitants, to Carson City, Nevada, with about 2,200; and it will perhaps be interesting at this point to give some of the results found, which includes to July 12, 1912, when the work was practically completed.

SUMMARY OF APPARATUS EXAMINED BY INSPECTORS OF WEIGHTS AND MEASURES, BUREAU OF STANDARDS

		Percentage
Total number of scales tested	10,034	
Correct	5,535	55.2
Incorrect	4,499	44.8
Total number of weights tested	12,211	(partly estimated)
Correct	9,792	80
Incorrect	2,419	20
Total number of dry measures tested	5,656	
Correct	2,935	51.89
Incorrect	2,721	48.11
Total number of liquid measures tested	2,407	
Correct	1,761	73.16
Incorrect	646	26.84
Total number of stores visited	3,220	
Total apparatus of all kinds inspected	30,500	

This shows that nearly 45 per cent. of all the scales tested were three or more per cent. in error, and when the rapidity with which a tradesman sells his wares is considered, even three per cent. is an important consideration; and when it reaches twelve, as it did in a number of cases, the loss to the purchaser is a serious one. It is not only the purchaser who suffers from the use of such apparatus, but the honest dealer is placed at a great disadvantage by reason of the fact that the possessor of such a scale can apparently undersell him and yet actually charge more for his goods. To show how apparently small errors run into money, we shall take the case of print butter. It will suffice for our purpose if we select states from different sections of the country, and base our conclusions upon what is found there. Let us take the states of Alabama, California, Massachusetts, Montana, Nebraska, New York, Texas, Utah, and the District of Columbia. The number of prints of butter of various sizes weighed in these states was 3,972, aggregating some 4,434 pounds of the commodity. The average shortage of all this

butter was found slightly to exceed ½ oz. per pound, or 3.25 per cent. According to the Bureau of Labor (now the Bureau of Labor Statistics), the normal male adult in all parts of the United States consumes about 30 pounds of butter per year. Tables issued by the same bureau show the percentage of this amount consumed by female adults, children of various ages, etc. By combining these data with the information issued by the Census Bureau as to the number of male and female adults, children, etc., we reach the conclusion that the amount consumed by the total population would be equal to the amount consumed by a number of adults represented by 80 per cent. of the population. The population of the country according to the census of 1910 is approximately 92,000,000, 80 per cent. of which is 73,600,000. Multiply this figure by 30, the number of pounds of butter consumed by one adult, and we find that the total consumption in the United States amounts to about 2,200,000,000 pounds per year. Much of this butter is sold in bulk, but there is no section of the country where print butter is not extensively sold. In the western states it is retailed in no other way. In the eastern states from 25 per cent. to 50 per cent. of it is handled in this form. It is a very conservative estimate to assume that 35 per cent. of the butter consumed is put up and delivered in this form. It may be said, then, that some 770,000,000 pounds of butter are sold yearly in print form, and since the average shortage, as mentioned above, is about 3.25 per cent., the yearly loss on butter in this form is, therefore, 25,000,000 pounds. Assuming that the average price of butter throughout the country is 33 cents per pound, the annual loss to the consumer is more than $8,250,000.

That some of the shortages found in butter are not accidental, but are the result of deliberate fraud, is proved by a comparison of the weight of the same brands of butter in Denver and Cripple Creek, Colorado. The city of Denver has an ordinance requiring that all prints of butter sold in the city must be labeled with the correct net weight of the contents, and this ordinance is being enforced by a sealer of weights and measures. The city of Cripple Creek has no ordinance and no inspector of weights and measures. Five brands of butter were found on sale in both cities, and all of them were labeled with the weight of the contents, "One Pound," in Denver, while two out of the five brands omitted the statement of weight in Cripple Creek, although the butter was still sold as pounds. The average weight of all the prints of the five brands in Denver was 15.72 oz., a shortage of 1.75 per cent., while the average weight of all the prints of these same five brands in Cripple Creek was only 15.02 ozs., a shortage of 6.12 per cent.

The same kind of losses could be shown to result from the use of false capacity measures, although it is not so easy to prove the figures, on account of the comparative roughness with which such measures are used. Such losses as these are likely to result from the use of rela-

tively correct apparatus such as would be found in first-class stores. Aside from these and by far the larger individual losses are those resulting from the use of false weights and measures and intentional cheating either with false or comparatively correct apparatus. False apparatus is generally very crude in construction and may easily be detected upon examination, although in some cases test with standards are necessary. The users of such apparatus depend to escape detection upon the unsuspecting attitude of the purchaser and their own dexterity in handling the apparatus. Methods of cheating and false apparatus represent wide varieties. Among the different types of false measures might be mentioned those having movable or false bottoms; measures having a portion of the height cut away from either the top or bottom; measures with staves removed and the hoops and bottom adjusted accordingly; "bottomless" measures which have relatively small diameters and high sides, and which, although they contain the proper number of cubic inches, give incorrect quantities on account of not permitting of a proper heap; measures with false interiors, such as have been found in milk cans and measures for selling gasoline; and liquid measures used for dry commodities. This last practise is found in use to some extent in practically all parts of the country and results in a shortage of about 14 per cent. It is one of those practises which has come into use largely through "trade custom." The use of correct scales of high quality is not in itself a guarantee that correct amounts will be given, for it is possible for the user of such apparatus to manipulate it to his own advantage; but it is usually with the poorer apparatus and small dealers where intentional fraud is found. A type of scale which was formerly common among certain classes of dealers is the straight-face hand scale, with the graduated face made movable so that the dealer might lower or raise it so as to make the pointer indicate a lesser or greater amount than actually was the case, according as he was buying or selling. Even-arm balances of cheap construction may be made to vary considerably by placing the weights and commodity in certain positions on the pans, which is done in an apparently unintentional manner by the dealer and which would not be noticed by the customer unless he were familiar with the action of such scales. Counter-beam scales with a movable scoop and counterpoise may very easily be used fraudulently by omitting the counterpoise when the scoop is in place. These are a few of many ways in which apparatus designed to give correct results may be changed or used to give incorrect amounts.

The results of the investigations, which were furnished to the state and local officials, were an important factor in convincing the legislatures of the states that the state laws and the facilities provided for carrying them out were in most cases entirely inadequate to protect the public not only from the use of fraudulent apparatus, but also the fraudulent use of correct apparatus. The wide publicity given in some

of the magazines and newspapers to the work of a few of the more progressive states also contributed to concentrate the attention of the state legislators on the necessity for a more efficient supervision of commercial weighing and measuring. Let the reasons be what they may, the past two or three years have seen the most astonishing activity in the legislatures of the states.

The original idea of the Bureau of Standards was to have the states adopt uniform laws and then to enforce them. It did not take it long, however, to learn that it would be an impossibility to get the same law passed by all the states. It was also evident that even with the same law, the enforcement by the different states would be anything but uniform. The idea now, therefore, is to secure uniformity as far as possible with such changes as are necessary to meet local conditions, and enough federal legislation to give the government the authority to regulate the matter so far as interstate commerce is concerned. It is obvious that an individual or corporation doing business in all the states should not be compelled to conform to conflicting state laws.

During the past two of three years the following legislation was enacted in the states:

Alabama passed legislation amending the law in relation to the sale of certain specified feeding stuffs. It is now required that when put up in original packages they may only be packed in certain specified sizes and the net weight must be plainly stamped on the outside of the containers. This is a good law and a step in the right direction, but it is very greatly restricted in its operation on account of the small number of commodities specified.

Arizona passed a general weights and measures law during the first session of the legislature after being admitted to the Union, which shows the importance of this subject in the minds of the legislators of that state. The law is based directly on the model law recommended by the National Conference on Weights and Measures, many of the sections having been enacted without material change. On the whole the law is a good one, and Arizona is to be commended upon its general effectiveness and its early passage. The system adopted requires the appointment of city sealers in all cities of more than 5,000 population who are placed under the supervision of the state inspector. In cities of less than 5,000 and more than 1,000 population the work of inspection is to be done directly by the state inspector. Communities of less than 1,000 people do not seem to have been provided for in this law. In addition to the sections relating to the inspection of apparatus there are provisions requiring most package goods to be marked with the net weight or quantity of the contents, and others regulating the sale of wood, ice, hay, fresh meats, butter, etc. Later the scope of the law was broadened by requiring that the testing of water, gas and electric meters should be in charge of the city sealers and the state inspector of weights and meas-

ures. The most unsatisfactory feature of the legislation is that requiring fees to be collected from those for whom inspections are made; but fortunately the state inspector and city sealers are to be paid by salary. The ale gallon of 282 cubic inches adopted for the sale of beer and ale should not have been established, since this measure is not recognized by the federal government.

Arkansas passed somewhat similar legislation in 1911 and later enacted a law directing and requiring that the county clerks comply with the provisions of a law passed in 1894, requiring that the county clerks procure a complete set of standards and seal all weights and measures that may be presented to them for that purpose which correspond with the county standard. The law also provides that the township constable and the town or city marshal shall make annual inspections of the weights and measures in their respective jurisdictions, and stipulates a penalty of $1 a day for failure of the user of weights and measures to have his apparatus tested and sealed before the first day of September of each year. The enactment of this law shows an awakening interest on the part of Arkansas in a subject which has laid dormant in that state for many years; and while the system adopted will not attain the highest results, it is hoped that it may be only a forerunner to the establishment of a state-wide inspection of weights and measures along the most approved lines.

California has been exceedingly active in its endeavor to protect the people of the state, although it has never been represented at the National Conferences on Weights and Measures. During the visit of our inspector a proposal was made to one of the state senators that he undertake to draft a bill covering the matter. It was at once seen that this would be a difficult task on account of a provision of the constitution which forbade the appointment of a state sealer of weights and measures and made it impossible to compel the cities and counties to appoint such officers. A bill was finally drafted which was probably the best that could be passed under the constitution. Also a constitutional amendment was introduced designed to remove this disability from the state. Both the bill and the constitutional amendment were successful, and a number of counties and cities appointed sealers under this law. The bills were passed almost unanimously, the reports issued by the Bureau of Standards upon conditions as they were found to exist aiding greatly in the passage. A special election was held in October, 1911, and the weights and measures amendement and a number of other constitutional amendments were voted upon by the people. This provision was passed by an overwhelming majority. At a recent special session of the legislature a new bill was introduced containing all the provisions recommended by the conference. This bill passed the senate almost unanimously and appeared certain to become a law, but opposition developed in the assembly taking the form of amendments de-

signed to decrease the effectiveness of the law. At a conference the senate refused to concur in the amendments and on account of the lack of time the bill failed of passage. Ten thousand copies of the reports of the Bureau of Standards, showing the necessity of inspection service and the extremely bad conditions existing were printed by the senate and with this assistance the bill became a law at the next session of the legislature.

There was also passed a net container law applicable "to food-stuffs and stuffs intended to be used or prepared for use as food for human beings" and "to any commodity intended to be eaten or drunk by human beings"; but it does not apply to commodities intended to be used solely for medicinal purposes or to a quantity of a commodity that is sold for less than eleven cents at retail. The act contains several provisions concerning the manner of marking the net weight, measure or numerical count, and fixes a minimum penalty for violation of $25 and a maximum of $500.

Colorado passed four laws on the subject of weights and measures at the 1913 session of its legislature, prior to which this subject had been a dead letter in Colorado for nearly a score of years. One of these laws gives the Public Utilities Commission power to examine and test all water, gas and electric meters; another requires persons or corporations engaged in business of mining and selling by weight to keep constantly on hand the necessary apparatus to correctly weigh their product, and provides for the annual inspection of such apparatus and makes further provision for the proper weighing of coal mined in the state; a third law requires that oleomargarine be put up in print form of one half, one, two, three, and five pound prints and in no other larger or small subdivisions, and sets forth other restrictions regarding the marking of the weight; and the fourth law provides against the false reading or manipulation of the Babcock test for milk and cream.

Connecticut passed a most excellent law including nearly all the provisions recommended by the conference for general legislation, and also requiring the net contents to be stamped on the outside of all original containers of food.

Delaware passed two laws; one requiring that a standard ton of coal shall consist of 2,240 pounds and providing a heavy penalty for violation, and the other law specifies standard cups, hampers, baskets, barrels, etc., to be used in shipping berries, fruit and produce. The latter law is not mandatory, but permits the use of other size containers when properly marked with the amount that they contain.

Florida failed to pass any general legislation requiring inspection service, but this state distinguished itself by amending its pure food law so as to require that the net contents of all original packages should be "conspicuously, legibly, and correctly stated" in terms of weight or measure, on the outside of each package.

Idaho passed a law at the last session of its legislature which establishes the customary standards and materially enlarges the powers and duties of the state sealer of weights and measures who, by a former act, is the dairy, food and sanitary inspector of the state. The present act makes it mandatory for the state sealer to test and seal or condemn all apparatus used in the state. Cities and municipalities are given the power to appoint sealers and pass ordinanecs not in conflict with the laws of the state. A large number of dry commodities for which legal weights are specified, must be sold only by weight; berries and small fruits, when sold in boxes, must be sold only in those containing a standard dry quart or dry pint unless information that the boxes hold less than this amount is given to the purchaser and a statement of the net contents is labeled on the box; milk and cream must be sold in standard size bottles; pails of lard must be labeled with the net weight; prints of butter containing less than 16 ounces must be labeled with the weight; and bread must be sold by weight.

Illinois passed a law which is lacking in scope and does not provide any officials whose sole duty it is to enforce the law, but its execution depends upon the Secretary of State who is *ex-officio* sealer of weights and measures, and the county clerks of the several counties who are county sealers of weights and measures; the former being charged with the care and custody of the state standards and the trying and proving of the county and municipal standards, and the latter with the duty of trying and proving all weights and measures, scales and beams within their respective counties when requested so to do. Fees are provided for the payment of services rendered in testing and sealing; and this is a very undesirable feature of the law, as such a system is not conducive to the attainment of the best results, and is generally believed by weights and measures officials to be wrong in principle and unsatisfactory in practise. The weights per bushel of a large number of commodities are fixed. Section 17 of the law is worthy of commendable notice, since it gives authority to weights and measures officials to seize and hold for use as evidence in any suit any short measure or faulty or incorrect weighing or measuring instrument or any commodity or article of merchandise which is of less weight or measure than represented, and the sealer is not held liable to the owner of the property seized for damages caused by such seizure where reasonable grounds existed for the action of the official. While the law is incomplete in its provisions, in fact, is entirely lacking in many which are indispensable to the attainment of the best results in weights and measures work, inadequate in the machinery provided for its enforcement, and not in keeping in progressiveness with the position of Illinois among the sister states of the Union, it is to be hoped that the start thus made will expand, and that a competent law and adequate force will soon be had.

Indiana introduced a bill to amend the law passed in 1911, and, after

much debate and some amendments, it was finally enacted into law. One of the principal objects of the bill was to make it mandatory on the counties to appoint sealers of weights and measures, the original law merely being permissive in its terms. The bill, as originally introduced, required all counties with over 20,000 population and all cities of the first and second classes to appoint such officials. As finally passed, however, the only counties required to appoint sealers are those of 40,000 or more population which do not contain a city of the first, second, third, or fourth classes already having such an official. As a result of thus increasing the population requirement the number of new sealers required to be appointed was very materially reduced. There are other features of the law which are both important and excellent ones; for instance, that putting the city sealers under the municipal civil service regulations, and that requiring all commodities to be sold by weight, measure or numerical count rather than in the indefinite manner so common heretofore.

Iowa passed a general law which contains some of the provisions recommended by the National Conference on Weights and Measures. The state dairy and food commissioner is charged with the duty of carrying into effect the provisions of the law and is required to appoint a chief inspector of weights and measures with the approval of the executive counsel, and the appointment of other inspectors is provided for. The dairy and food commissioner is also required to appoint an employee of the dairy and food commission to be state sealer of weights and measures, who is charged with the care and custody of the state standards, general supervision over the weights and measures and weighing and measuring devices of the state, and the testing and calibrating all apparatus used as standards in the state. The law fixes the weight per bushel of a large number of commodities and specifies that they shall be sold by weight unless there is a special agreement in writing to the contrary; but in the case of berries in packages of one peck or less they may be sold by the quart, pint or half pint dry measure, and all berry boxes must be of the interior capacity of one quart, one pint or half pint, dry measure. Confiscation of berry boxes not conforming to these standards is provided for. All dry commodities, weighing ten ounces or more, with few exceptions must be bought and sold by standard weight or numerical count, lineal measure, or surface measure, except where parties otherwise agree in writing.

Kansas was more or less active in passing weights and measures legislation, but its progress was very largely in a backward direction, if you will pardon the anomaly. The laws we criticize are two in number: the first specifies that flour and cornmeal when sold in sacks in amounts less than one barrel shall be sold by gross weight. The second law is no less inimical to sound legislation and good practise. This law establishes the liquid measure for the sale of berries and small fruits in

baskets in place of the dry measure which has heretofore been the universal standard for these commodities. A provision of the general law which has been found to be very obnoxious is the provision requiring the collection of fees for services rendered by the sealers of weights and measures. So firmly, however, is the fee system engrafted on the state that cities passing ordinances are not allowed to abolish them, but must always make the collections demanded. We are informed by the state officials that this requirement is the greatest stumbling block in the path of establishing a really efficient inspection service and eliminating faulty weights and measures from the commerce of the state.

Three other laws were passed at the last session of the legislature: one requires railroads to provide scales for weighing live stock at all stations where as many as 50 carloads of live stock were received for shipment during each of the preceding two years; another requires the net weight to be marked on commercial feeding stuffs; and a third law requires similar marking for live stock remedies.

The law passed in Louisiana provides for the inspection of weights and measures in the city of New Orleans only. The city is divided into two inspection districts for which two inspectors are to be appointed by the governor with the advice and consent of the senate, for a term of four years. Fees are to be collected for testing and sealing apparatus, but the inspectors are placed on a salary basis. Trade weights and measures are to be inspected and sealed annually, and it is made unlawful to use such apparatus without being inspected and sealed. Itinerant peddlers and hawkers using weighing and measuring instruments are required to bring them to the office of the inspector to be adjusted and sealed before using them, and to have the same adjusted and sealed annually. The law includes several provisions contained in the model law recommended by the National Conference on Weights and Measures. Another act was passed requiring ice wagons to be equipped with weighing devices, making it unlawful to charge and collect for a greater amount of ice than actually delivered to the consumer, under penalty of fine or imprisonment.

Maine passed one general and two special laws on the subject at the last session of the legislature. The general law is in the nature of amendments to the former statutes of the state, passed principally at the 1911 session, and adds a great deal to the strength of these laws. The major portion of the changes are based on sections of the model law recommended by the National Conference on Weights and Measures. A berry box section was included which requires all boxes for berries holding one quart or less to be of the capacities of one quart, one pint or one half pint, standard dry measure. The section specifying the weights per bushel of commodities has been extensively revised. An act relative to sealing milk bottles and jars requires these to be of standard

capacities with the usual tolerances, and contains most of the other provisions of the milk bottle section of the model law.

Maryland completely revised its statutes on the subject of weights and measures and the new law provides for a complete system of county and city inspection, under the salary system. The most serious defect in this law is the omission to provide any state supervision whatever. It has been found in the past that without some state officer to assist the local sealers, the enforcement of any law is lax and unsatisfactory and it remains to be seen whether Maryland can succeed where so many states have heretofore been unsuccessful.

Massachusetts made several important additions to the statutes during the past three years. In 1911 two laws were added in relation to the cranberry barrel and other packages and to the weight of a barrel of potatoes. In 1912 the list of legal weights per bushel for fruits and vegetables was amended and amplified and it was provided that all fruits and vegetables for which a legal weight was established should be sold only by numerical count or by weight, thus eliminating the use of the dry measure for a very large number of important commodities. At the last session of the legislature a determined effort was made to nullify this law and to reintroduce the old method of selling by measure, a bill being introduced to this effect. This passed the lower house but was defeated in the senate; so the ground gained has not been lost. The second important amendment was the passage of a bill making it unlawful to sell any commodity by any other weight than the net weight of the commodity. It is believed that the sale of commodities by gross weight can be prevented, regardless of any statement to the contrary, under the terms of this law. The abuse of charging retailers and consumers for wooden cores, backsticks, heavy burlap and paper wrappings, cord, etc., at the price of the commodity itself upon the strength of a statement upon the invoice or delivery ticket that the delivery is made "gross weight," may thus be eliminated in this state by a competent enforcement of this law. Other bills were also enacted requiring the measuring by sworn city or town officials of all leather sold by measure; and the testing and sealing or condemning of all machines used in the measuring of leather. On account of the very large shoe manufacturing industries in this state this subject is of very great importance here.

Michigan enacted legislation at the last session which was based directly on the model law. Some of the sections were adopted practically intact while others were amended in important particulars, these amendments in nearly every case, however, tending to weaken the original law. The state dairy and food commissioner is, by virtue of his office, the state superintendent of weights and measures for the state. His deputy is likewise deputy state superintendent of weights and measures and all inspectors in the dairy and food department are state inspectors of weights and measures as well. The next important amendment apparently prevents

the confiscation and destruction of incorrect apparatus. The provision that counties and cities appoint sealers of weights and measures is not mandatory, but they may do so "in their discretion." The penalty section has been weakened by requiring that before conviction it must be proven that short weight or measure has been "knowingly" sold or offered for sale. The difficulty of proving the state of a man's mind, even in flagrant cases of fraud is well known and need not be commented upon here.

Minnesota enacted an excellent law in 1911 providing for a state commissioner of weights and measures and a state inspection of the apparatus in commercial use. The most unfortunate provision of this law is that requiring the charging of fees for work done. The enforcement of this law should be of particular interest, since this state is among the first to abolish local sealers, putting the matter entirely in charge of state officers. Should its enforcement meet with success it may point out the proper method of inspection for some of the western states where a small number of people are scattered over a very large territory. At the last session of the legislature several valuable additions were made to the law. One section relates to the standardization of boxes used in the sale of berries, allowing containers of the capacities of one quart, one pint, one half pint or multiples of a quart, standard dry measure only; another provides for better equipment for testing railroad track scales; another gives the Warehouse Commission jurisdiction over the track scales used by common carriers and the power to require the installation of the same; it is still further provided that the Warehouse Commission may compel railroads to furnish scales for free public use in stockyards; and finally, there are general amendments to the weights and measures law of the state.

Missouri passed three laws: one authorizes cities of from 30,000 to 75,000 inhabitants to establish standards of weights and measures not inconsistent with the Federal and State standards, to provide for the inspection of all weights and measures and to prescribe the weight and quality of bread sold in the city; another gives the Public Service Commission authority to appoint inspectors of water, gas and electric meters; and a third law requires that the Commission shall appoint weighmasters at such places in the state where grain inspection and weighing may be established in conformity with the provisions of the law.

In 1911 Montana passed a general law which was on the whole a good one and contained a large number of the provisions of the model law recommended by the National Conference on Weights and Measures, but also included certain other features which were unsatisfactory, among these being the collection of fees for the work done and the appointment of county clerks as sealers of weights and measures. At the next session of the legislature this law was repealed and reenacted with important changes; and it appears that the statute has been greatly

strengthened and improved as a result. The county clerks are no longer designated sealers of weights and measures for their respective counties, but instead the state sealer is authorized to create weights and measures districts and appoint inspectors therein. The state sealer is given specific jurisdiction over the track scales of the state; a net-contents-of-container section was added to the law, as well as a general net weight provision; and the penalty section has been greatly strengthened. Another very important and excellent change is the abolition of the fees formerly required to be collected by the state sealer of weights and measures and his deputies for the work performed by them.

Nebraska passed, at the last session of its legislature, a weights and measures statute which is general in its terms but which fails to provide a mandatory inspection of all weights and measures in commercial use although it appears that it is possible to obtain this object under the terms of the law. The deputy food, drug and dairy commissioner is the deputy state sealer and to him and his assistants is entrusted the state supervision provided for under the act. These officials may test weights and measures but it does not seem that they are required to do so. Fees are to be collected for the work done by them, these fees to be used in the proper enforcement of the law. No other money is appropriated for this purpose. In the counties the county clerks are designated sealers of weights and measures. They are required to test apparatus only upon request although they may do testing work at other times if they so desire. Cities or municipalities are empowered to establish inspection services but are not required to do so. On the whole it does not appear that the act is a very satisfactory one, although it may be considered as a forward step in legislation in this state.

Up until 1911 Nevada was distinguished by the fact that it was the only state having no laws whatever on the subject of weights and measures. In that year a very satisfactory law providing for a state inspection of apparatus under the supervision of the director of the Nevada Agricultural Experiment Station was passed, and very wide powers were given to the state officials. No local inspectors were provided for, and rightly we believe, on account of the small population of the state and its large territory. To make up for its neglect in the past, perhaps, the legislation included in its provisions that original packages must be labeled "in plain intelligible English words and figures with a correct statement of the net weight, measure or numerical count of its contents." By a subsequent amendment to section 23 of this act, the commissioner appointed by the board of control of the Nevada Agricultural Experiment Station was made sealer of weights and measures and charged with the duties which formerly developed upon the director of the said station.

New Hampshire amended the penalty clause of the law in force, making it much broader in its scope. They also increased the powers

of the sealers to some extent, revised the schedule of legal weights per bushel, and passed an excellent berry-box section requiring that all such boxes used in the sale of specified berries shall be only of the sizes of one quart, one pint or half pint, United States standard dry measure.

New Jersey passed a very comprehensive law in 1911 establishing a state department of weights and measures, consisting of a superintendent and three deputy superintendents, and providing for the testing and sealing of apparatus by county and municipal superintendents. This law is directly based upon legislation recommended by the conference, but it was quite generally amended before its passage, to meet local conditions in the state. At the 1913 session of the legislature several amendments were passed, designed to strengthen the former law by making it possible to eliminate dealing which, while resulting in false representations and fraud, could not be attacked directly under the former provisions. Perhaps the most important of these changes is that standardizing the size of baskets used in the sale of dry commodities. Formerly all kinds of odd sizes were used and when these were sold in competition with each other it was very difficult for the purchaser to buy efficiently, since the amount to be obtained could not easily be ascertained. It is now made unlawful to manufacture, use, or offer or expose for sale any other baskets than the standard sizes mentioned in the act. Enforcement of this law should result in the elimination of misrepresentations of quantity and assure the purchaser of the quantity received. Another law gives the weights and measures officials police powers in connection with their work, and this will assist them very materially in many cases in bringing offenders of the law to justice. The penalty section has been strengthened and the procedure to be followed in the arrest and trial of offenders has been defined with great particularity. The magistrate shall hear and determine the guilt or innocence of persons summoned, in a summary way, and upon conviction a penalty may be enforced by execution against their goods and bodies without any special order of the court.

New Mexico passed a general law on the subject of weights and measures, designed to establish a state-wide inspection of the weights and measures in commercial use. The law is an inclusive one and evidently endeavors to cover the entire subject. While it has many excellent provisions the machinery provided for enforcement is very poor and it also contains many unsatisfactory and indefensible provisions. The legislation is not based on the model law of the National Conference, but does seem to have copied provisions from a number of other states. Some of the provisions which are considered poor ones will be mentioned briefly. The only state weights and measures official provided for is the secretary of state, ex-officio, and his only duties appear to be the providing and testing of county standards. The sheriffs of the counties are designated county weighmasters, these officials being allowed to appoint deputies to

enforce the weights and measures laws. Fees are to be collected for all work done and these fees are to be kept by the officials for their own use, no other compensation for the performance of the duties specified being provided. The only state standards required to be procured and kept are weights of specified sizes, although in a later section "all weights and measures accepted and used by the government of the United States at the present time, except herein provided" are standardized. The only commercial apparatus required to be tested and sealed are scales; weights, measures of capacity and length and measuring apparatus of all kinds being entirely neglected in this connection. All berries sold in boxes must be sold in boxes containing a standard liquid quart or liquid pint, and boxes of all other sizes must be labeled with their net contents. New Mexico has evidently followed the lead of Kansas in this matter, although such a provision is one of the most regrettable ones which could be included in a state law.

New York continued the good work which it commenced several years ago, and added to its excellent code of laws a very strong coal law, and a law making the possession or use of any false apparatus presumptive evidence of the knowledge of the user of its falsity. A law was recently passed requiring that all meat, meat products and butter shall be sold by weight, and that other commodities shall be sold by weight, standard measure or by numerical count, and that this amount must be marked on a label or tag attached thereto. The law further fixed the sizes of containers for vegetables, produce and fruit and provided that when these were sold in other than standard sizes the amount contained in these packages should be marked or branded conspicuously in terms of standard dry measure on the outside of the package. And it is also specified that when commodities are sold in containers of other sizes than those fixed by law the net quantity of the contents of each container, or a statement that the specified weight includes the container, the weight of which shall be plainly and conspicuously marked, branded or otherwise indicated on the outside or top thereof or a tag attached thereto, in terms of weight, measure or numerical count. During the 1913 session another law was passed standardizing the dimensions of four- eight- and twenty-pound baskets for use in the sale of grapes and provides that grape baskets of all other sizes must bear a statement of the net quantity of their contents in terms of weight, measure or numerical count. The section of the present code of laws relating to the marking of bales of hay and straw was strengthened by an amendment.

North Dakota took an important forward step by requiring that lard put up in pails or other containers should not only be marked with the net weight of the contents, but should also be put up in one, three or five-pound net-weight containers or some whole multiple of

these numbers, and not any fractions thereof. This legislation was taken into the courts and we are under the impression that it has recently been declared constitutional. A law requiring bread to be put up in standard size loaves or labeled with their weight was also put upon the statute books. A section of the code conferring certain powers upon cities was amended so as to permit the establishment of city scales and certain other powers, which now appear to be exercised by the state, were withdrawn from the cities.

Ohio, in 1910, placed the inspection of weights and measures under the direction of the state dairy and food commissioner, and the law gives him the authority to use the services of any persons employed under his department in the enforcement of the laws relating to weights and measures. The county auditors were made county sealers of weights and measures and are required to compare all weights and measures brought to them for the purpose with copies of standards in his possession, to see that the state laws relating to weights and measures are strictly enforced, and to assist generally in the prosecution of all violations of such laws. Mayors of cities and villages may appoint sealers of weights and measures. Several other laws relating to weights and measures were passed or amended at the 1910 session of the legislature. In 1911 several changes were made in the laws. The most important was the section making it necessary to sell a large number of dry commodities specified by avoirdupois weight or numerical count, unless all parties concerned agreed upon some other method of sale. This legislation is most important since it is the first statute passed by any distinctively eastern state attempting to eliminate the always-faulty dry measure from commercial use.

At the 1913 session Ohio strengthened the law requiring fruits and vegetables to be sold exclusively by numerical count or weight and has thereby made it possible to enforce its provisions competently. In the former law these commodities might be sold only as mentioned above, "unless by the agreement of all contracting parties." This phrase made it extremely difficult to obtain convictions even in cases of willful violation of the intent of the law. The amendment referred to requires these special agreements to be in writing and hereafter it would seem to be an easy matter to bring all offenders against the spirit of the law to justice. The section requiring berries and other small fruits to be sold by a bushel or fractional part thereof has been amended to require the subdivision of the bushel to be an aliquot part thereof. Dry measures have been standardized as to the diameter and depth to be required. The state sealer has been given the power "to make, publish and enforce such rules and regulations as may be necessary to the prompt and effective enforcement of the weights and measures laws of this state." A special section requiring the testing of the computing part of computing scales has been added; and finally, the word "knowingly" has been stricken out of the penalty

section. All of these latter amendments seem to be excellent ones and do much to strengthen the weights and measures law of the state.

Oklahoma during the years 1910–1911 revised the list of legal weights per bushel, required certain commercial feeding stuffs packed in sacks to bear a statement of the net weight of the contents, made some changes in the coal mining law, and standardized the weight of flour and meal put up in barrels and sacks and required the weight to be branded on the same. As in the case of Kansas, flour in cloth sacks may be branded with the gross instead of the net weight.

Oregon passed one general and four special laws relating to weights and measures at the 1913 session of its legislature. The general law establishes a state department of weights and measures under which the state treasurer (who it appears from the context is subsequently referred to as the state sealer) is required to appoint a deputy state sealer and has authority to appoint such assistant and clerical aid as may be necessary to place in practical operation the provisions of the act. He is further authorized to procure such standards and other equipment as may be necessary for the proper execution of the duties under the law and to procure and use only such standards as have been passed upon as correct by the National Bureau of Standards and to have the state standards tested by that bureau once in ten years. The county courts of the several counties are required to appoint competent sealers for such term and at such compensation as they may decide; but such sealers may be removed from office by the deputy state sealer for incompetency, or neglect of duty. The county sealer is required to visit at least once in each year every place of business where weights and measures are kept for the purposes of trade. The law places no restriction upon the rights of cities to enforce ordinances providing for the sealing of weights and measures or regulating the sale of commodities, provided such ordinances are not in conflict with the standard adopted by the state. It is made unlawful in selling any commodity by weight or measure to include the weight or measure of anything other than the weight or measure of the commodity itself. The law, while lacking in some respects, contains a number of excellent provisions and may in general be said to be a good one. The four special laws referred to above, provide as follows: One establishes a weight of 100 pounds, inclusive of the weight of the sack, as the standard weight of a sack of potatoes, unless otherwise specified by contract; another stipulates that in selling farm or range products where no special agreement is made to the contrary, no deduction shall be made for the weight of the sack containing the products; another refers to the sale of butter, and requires among other things that this product when offered for sale in rolls, prints or squares, shall be plainly marked "Sixteen ounces, full weight," or "Thirty-two ounces, full weight," and shall contain the number of ounces so marked; and the fourth law amends a former act and places all track scales used by railroad companies under

the jurisdiction of the Railroad Commission, the Commission being required to test and inspect such scales from time to time, the cost of which is chargeable to the owner of the scale.

Pennsylvania passed a law in 1911 establishing a state bureau of standards, under control of an officer to be known as "Chief of the Bureau of Standards," with very limited powers. The counties and cities were authorized, but not required, to appoint inspectors of weights and measures and the powers and duties of these officers were specified. This law did not require any compulsory inspection service, either state or local, and was inadequate on this account. At the 1913 session the above-mentioned law was amended in several particulars which has greatly strengthened it, and it now becomes possible to secure far greater results than formerly. The permissive character of the act relating to appointment of weights and measures officials is now made mandatory, and requires that mayors of cities of the second and third classes and the board of county commissioners of the several counties shall appoint one or more competent persons as inspectors of weights and measures. In cities of the first class, the inspectors are to be appointed by the board of county commissioners of the county in which such city is located rather than by the mayor of the city. It is provided in the law as amended that the county and city inspectors shall hold office during good behavior, and shall not be removed, discharged, or reduced in pay or position, except for inefficiency, incapacity, conduct unbecoming employees, or other just cause, and until said officials shall have been furnished with a written statement of the charges against them, and shall have been given reasonable time to make written answer thereto. This provision practically means civil service, and puts the inspectors beyond removal for political reasons, and permits them to become proficient in their work and to remain in office, thus rendering to the community better and more efficient service than would be had with constant change of inspectors at intervals of one or two years. Another act was passed relating to the sale of commodities, which specifies the manner of sale of certain kinds of products, and attempts to prevent misrepresentations and the use of fraudulent apparatus. This act also fixes the number of pounds per bushel for a large number of commodities in section 6, and in the following section, requires the net weight, measure, or numerical count to be marked on packages; but it is not mentioned in this section what commodities or classes of products in package form are required to be so marked. It might be inferred from the context that reference was made to the commodities mentioned in the preceding section, but such a construction does not appear to be a reasonable one.

South Carolina passed legislation fixing a standard weight per bushel for a very large number of dry commodities and also providing for standard barrels for various purposes. It is made unlawful to sell any of the products mentioned "except in strict accordance with the standard

weights and measures" so provided, and means of enforcement and penalties for violations are included in the act.

South Dakota has not enacted any general laws, but in 1911 amended the food and drugs act to require the true net weight to be branded on all food sold in original packages " in clear and distinct English words in black type on a white background, said type to be in size uniform with that used to name the brand or producer." At the 1913 session of the legislature a law was passed establishing the bushel, and subdivisions, as the standard for all dry commodities, and fixing the weights per bushel of a large number of products. It is also made unlawful in the sale of grain to take a greater amount as dockage for dirt, foul seed or other mixture than is actually present.

Tennessee passed a general law on weights and measures, making the state pure food and drug inspector the state superintendent of weights and measures, and designating his assistant and deputy inspectors as assistant sealers, with like powers and authority as the county and city sealers. The president of the University of Tennessee is made the state sealer of weights and measures, and among other duties, is charged in conjunction with the state superintendent, with the care and custody of the standards and the inspection and testing of the standards of the several cities and counties, and the testing and calibrating, when presented for the purpose, of apparatus used as standards by any citizen, firm, corporation or educational institution of the state. The state superintendent or his deputies are required to inspect the work of the county and city sealers once in two years, and for this purpose have the same powers and authority as the county and city sealers. The law relating to the appointment of county and city sealers is only permissive in its terms, and presents one of the weakest features of the act. The powers granted to, and the duties required of, the county sealers (and likewise of the city sealers and assistant and deputy inspectors of the pure food and drug department) follow very closely those contained in the model law recommended by the National Conference on Weights and Measures, and are potentialities of far-reaching possibilities and capable of accomplishing a vast amount of good in the state if the county and city authorities avail themselves of the opportunities afforded by the law. Otherwise, it does not appear that much can be accomplished, unless the state superintendent is able to have a considerable portion of the time of his assistant and deputy inspectors devoted to the inspection of weights and measures, the appropriation allowed for use in the inspection of weights and measures being only one thousand dollars. The state superintendent, in conjunction with the state sealer, is required to make rules and regulations for the enforcement of the act and for the guidance of all city and county sealers.

Texas passed an act requiring ginners of cotton to mark the weight of the bagging and ties in which the cotton is wrapped upon each bale

of cotton ginned by them, in figures at least four inches in height. It was required that the net weight of the contents be stamped upon bags, barrels and packages of fertilizers.

Utah in 1911 passed a law general in its terms but very incomplete in its provisions, making the state food and dairy commissioner *ex-officio* state sealer of weights and measures and giving him the power and making it his duty to try and prove all apparatus in use in the state, except in cities having a city sealer. No compulsory local supervision is provided for. Three other laws were passed at the 1913 session of the legislature, the most important one being a net weight law with reference to food in package form, which follows very closely the wording of the amendment to the national law on this subject. The other two laws have reference to the collection of freight charges on cars of coal and the weighing of coal in carload lots; the object of the laws is to ascertain the net weight of the coal, it being provided among other things that the cars shall be weighed before and after being loaded with coal.

Vermont enacted a general law in 1910 providing for a state supervision of weights and measures and authorizing but not making obligatory local supervision, also. This legislation was very satisfactory as far as it went. Subsequently it was amended and strengthened in several particulars. The state department of weights and measures now has specific jurisdiction over the scales used by common carriers; is empowered to seize, for use as evidence, commodities, packages or other articles offered for sale in a manner contrary to law; and is required to pay particular attention to the weights and measures used in creameries. The intentional misrepresentation by the buyer of the amount of commodity purchased is made a punishable offense; and the section relating to the legal weights per bushel was greatly amplified and strengthened.

In 1911 Washington enacted legislation requiring railroad companies to have track scales, and to furnish, jointly, a test car or other device for the use of the Railroad Commission in testing track scales, the railroad companies being required to move the car free of charge. In 1913 there was enacted legislation providing for a state-wide inspection of the weights and measures in commercial use, this law containing most of the provisions of the model law recommended by the National Conference on Weights and Measures. The state inspectors are put in the department of the secretary of state, this official being made *ex-officio* superintendent of weights and measures. The actual work will be taken care of by a deputy superintendent and one inspector. City sealers are required to be appointed in all cities of the first class, while in the counties the auditors are made sealers, *ex-officio*. As in the case of the state, a deputy sealer is required to be appointed in each county, having the same powers as the auditor in respect to this Act, and upon these officials will fall the duty of seeing to the enforcement of the law. In addition to the sections taken from the model law, the manner of sale of butter,

bread, potatoes in sacks, berries in boxes, coal in sacks, milk in bottles, and vinegar, ice, and wood are provided for. In regulating the scale of the above-mentioned articles in packages, standard sizes are specified which do not have to be marked with the net contents, but when any other size than the standard is packed, the net contents in terms of weight or measure must be stated on the outside of the package in plain English words and figures.

Wisconsin enacted an excellent general law on the subject, providing for a state supervision of weights and measures under the direction of the state dairy and food commissioner, who is made *ex-officio* state superintendent of weights and measures, and for a local inspection in charge of city sealers in all cities of five thousand inhabitants or more. This law contains nearly all the provisions endorsed by the National Conference on Weights and Measures.

Several amendments were made to this law in 1913. Among the most important of these is one conferring greater authority upon the state superintendent of weights and measures concerning the appointment and compensation of employees, and another requiring food in package form to be marked with a statement of the net weight, measure or numerical count.

Wyoming has not enacted any general legislation on the subject, but a law relating to food was passed in 1911 requiring that "if in package form, the net quantity of contents be plainly and conspicuously marked, on the outside of the package in terms of weight, measure or numerical count." The law in reference to the measurement of hay in stacks was amended, as was also the law in relation to the weighing of coal in mines. In 1913 a law was passed relating to the inspection and analysis of illuminating oils (including gasoline for the purposes of the act) which provides that the absence of the net weight properly labeled on the packages shall be prima facie evidence that they are misbranded.

Altogether forty-one states passed legislation of some sort directly referring to the subject of weights and measures. The statutes in twenty-four of these were general in their nature and authorized or required state-wide local inspection service under the general supervision of a state department of weights and measures; state-wide inspection service under officers of the state without any local inspection service; or local inspection without any supervision by the state. Twenty-eight states passed legislation requiring the weight or measure to be branded on the outside of some original package goods when sold in the original package or required the package or container to be of certain sizes. Of these sixteen referred to some few specified commodities, while twelve were general in their terms. This record shows the remarkable interest that has developed in the last few years and clearly points out the necessity for federal legislation to take care of interstate transactions.

The above list does not show all the activity by any means. A

large number of states introduced legislation of some sort but were unsuccessful in enacting them into laws. In a number of these states the idea was new and the bills did not receive sufficient consideration on that account. In others they failed through lack of time at the end of the legislative session, or for other reasons.

There is another phase of the subject that has not been touched upon that is perhaps more important than the supervision of the weighing and measuring apparatus of the tradesman, because of the fact that the amount involved in any transaction is not stated, and that is the sale of goods in sealed packages without any statement as to the quantity in the package.

Prior to the passage of the Food and Drugs Act, it was customary to mark such packages with some whole number of pounds or ounces. Most readers remember the two-pound packages of cereals, and the three and five-pound cans of lard extensively advertised and sold some years ago. It is possible that the weights marked upon them were originally correct, but it is certain that they were not so in 1906, when the Food and Drugs Act went into operation, because the packers immediately stopped marking such packages, on account of the provision in that act which requires that if any weight or measure be stamped upon any package it must be the correct weight or measure. The influences behind the Food and Drugs Bill attempted to have this section read so that the correct weight or measure of the contents should be stamped upon the outside of the packages, but the packers had enough influence to have it modified. The result was that the packer was at liberty to reduce the size of his package as often as he deemed it advisable, and without the knowledge of the purchaser; and this has been done in numerous instances.

The passage of laws by a number of the states, requiring the marking of the net weight, measure or numerical count upon the outside of articles put up in sealed packages, and the delegation of authority by such laws to state officials to promulgate rules and regulations concerning the enforcement of the laws soon convinced the manufacturers and packers that it would be much better to comply with the terms of a national law than to attempt to meet the demands of a number of state laws, which would not only present a multiplicity of regulations but would undoubtedly be conflicting in some instances. Accordingly when the Gould bill was introduced in Congress to amend the Food and Drugs Act so as to require the net weight, measure or numerical count to be plainly and conspicuously marked on the outside of food packages there was not sufficient opposition to prevent its passage, and after some changes it became a law March 3, 1913, and was one of the last acts signed by President Taft.

Aside from the weights and measures provision contained in the Food and Drugs Act, the amendment of March 3 is the second and most important step taken by Congress to exercise authority over weights and

measures in interstate commerce, which it has ample power to do under the express authority conferred upon it by the constitution. The assumption of federal authority in this instance points out the proper method for the solution of other weights and measures problems; and the enforcement of this amendment, it is believed, will present convincing evidence of the judiciousness and necessity of federal regulation over matters of an interstate nature, or where the exercise of authority by the individual states would be conflicting, or unnecessarily cumbersome on account of its multiplicity.

The proper regulation of types of weighing and measuring apparatus is one of the problems referred to which could be regulated by the federal government more scientifically and better than by the individual states and with more economy to the manufacturers of apparatus. Much apparatus now sold is faulty in design, false in its indications, and would not be permitted in any other important country in the world. A number of the states have already adopted specifications which the manufacturers are required to follow in making the apparatus sold in those states. They are in many cases imperfectly drawn, and on account of their lack of agreement with one another, the manufacturers are required to change their construction for some states, thus increasing the cost without accomplishing any useful purpose. The need of proper supervision over types of weighing and measuring apparatus has been felt for some time by weights and measures officials and is now beginning to be appreciated by manufacturers. The effect of such supervision would be to eliminate from use types of apparatus which facilitate the perpetration of fraud, and poor apparatus of cheap construction; and would in general standardize apparatus and practises. Bills have been introduced in Congress from time to time to confer upon the Bureau of Standards the authority to pass upon types of weighing and measuring apparatus, but no law has yet been passed.

Another problem of far-reaching effect upon the interstate commerce of the country is the proper supervision of railroad track scales. This matter was recently brought to the attention of Congress by the Bureau of Standards, and its request for an appropriation of $25,000, which became available July 1, 1913, was granted. Out of this appropriation a special test weight car has been provided with which a number of railroad track scales have already been tested, disclosing large discrepancies and plainly showing the need of supervision. The purposes of this car are to provide, as far as practicable, official standards heretofore lacking for the testing and standardizing of railroad track, elevator and other scales, and to obtain data for determining what tests are adequate to insure reliable adjustment of such scales, and upon which may be based specifications for their construction and operation.

THE STRUGGLE FOR EQUALITY IN THE UNITED STATES.

V

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The Courts and Property

THE constitutional safeguards which surround private property in the United States are exceptionally strong. Between confiscation and the multitude stand the state and the federal courts. In Cutting *v.* Goddard, decided in 1901, the Supreme Court held that a return of 10.9 per cent. on the investment is not unreasonably high and that a return of 5.3 per cent. is unreasonably low.[1] In decreeing the dissolution of the Standard Oil and the American Tobacco Companies, the same tribunal left the defendant companies in possession of everything which they had succeeded in amassing by unlawful methods. Nowhere in either of these decisions is there any hint that restitution ought to be made. On the contrary, every precaution necessary to conserve the property which monopoly control had garnered together was scrupulously observed. In the course of the Standard Oil decision, the Chief-Justice remarked "that one of the fundamental purposes of the statute (the Anti-trust Act) is to protect, not to destroy, rights of property."[2] No penalty was inflicted other than dissolution and the prohibition of acts violative of the statute. So far as constitutional guaranties are concerned, the most strenuous advocate of property rights could scarcely ask for anything more.

I

Nevertheless, the extent to which the Supreme Court conserves the rights of property is easily exaggerated. The Dred Scott decision did not prevent the overthrow of slavery, and moreover without compensation. On the contrary, it hastened its downfall and proved to be the one thing from which the slave power might well have prayed to be delivered. Much comfort was extracted by an influential portion of the property-owning class from the income tax decision in 1895, but the cost of what was gained from that decision has seldom figured properly in the account. Probably no decision of the Supreme Court since the Civil War has excited so much dissatisfaction or fallen so flat. In the opinion of many the court as now constituted would find a way of upholding a similar measure even though the constitution had not been amended. To save the face of the court was the strongest argument

[1] William Z. Ripley, "Railway Problems," p. 578.

[2] United States Supreme Court Reports, Vol. 55, Law. Ed., October, 1910, p. 652.

for proposing the income-tax amendment. But the decision of 1895 fanned the fires of social discontent. It unmasked the motives of those opposed to an income tax. On the one hand, are those well able to bear the burden of taxation upon whom a properly administered income tax would to a considerable extent rest. On the other hand, are the beneficiaries of protection who fear that an income tax will deprive them of one pretext for the maintenance of the tariff. The glaring injustice of any income tax apportioned among the several states according to population, in conformity with the court's decision, made such a tax impracticable. One effect was to discredit the court itself. Another fact had a similar effect. In its first decision, the court divided evenly on certain of the points at issue. After reargument it stood five to four against the act on these points. Far from conserving the social order, the in come-tax decision did quite the reverse.

Professor Daniels says:

> The decision or, more strictly, the decisions of the Supreme Court which killed the Income Tax of 1894 made a great deal of history, and unmade, or, at all events remade, a good deal of law. It certainly traversed legal expectation, it jostled the doctrine of *stare decisis*, it contravened previous decisions, and it discredited a good many dicta which had already become "blessed words" among authoritative text writers and accredited authorities on constitutional law. . . . The deliverance of the court can be explained only by reference to what has been happily termed "psychological climate." . . . The Supreme Court had reversed its own decision before, but except in the legal tender cases no modern decision had been reversed which bore very directly upon the stirring political issues of the day. But the court evidently had not been appealed to in vain upon the issue that the tax was a stride towards socialism, and the "weightier matters of the law" seemed to have been forgotten under the shadowy sense of dread which the dim specter of socialism invoked. The most venerable member of the court gave emphatic utterance to the feeling which moved him. "The present assault upon capital," said Mr. Justice Field, "is but the beginning. It will be but a stepping-stone to other, larger and more sweeping, till our political contests will become a war of the poor against the rich, a war constantly growing in intensity and bitterness."[3]

Probably the Dartmouth College case has been more often quoted than any other as indicative of the jealous care with which the Supreme Court safeguards property rights. But few decisions illustrate better the relativity of judicial decisions to the circumstances existing at the time and place. When the decision was handed down, business was still conducted on a very modest scale, and the era of the corporate form of business organization was yet to come. In view of the important respects in which the doctrine of charter rights has been modified in subsequent cases, it is probable that the decision handed down in 1819 would have been different if the industrial changes of the next fifty years had been foreseen. Some one has aptly said that the Supreme

[3] Winthrop More Daniels, *op. cit.*, pp. 199, 200 and 206.

Court follows the election returns. As it was, it appears that Chief Justice Marshall succeeded in bringing a majority of the court to his point of view only by means of methods which in the light of to-day are so high handed and questionable that they would hardly be tolerated for a moment.[4]

The potency of the courts to protect property rights depends upon public opinion. Respect for the law is not always at a maximum in the country having the most laws. "It is not the existence of statutes," writes President Hadley, "which makes murder a crime; it is the growth of a public opinion which makes the individual condemn himself and his friends, as well as his enemies, for indulgence in that propensity." The chance of convicting prominent business men under the criminal section of the anti-trust act until recently has been so slim that it was not worth while to bring suit. During the disorders attending the strike of employees on railways centering at Chicago in 1894, public feeling ran so high that the injunctions issued by the federal courts were not vindicated until much of the irreparable injury forbidden by the courts had been inflicted upon the railways and those dependent upon their services. The damages which the railways have since recovered by suits at law for the destruction of property are but a tithe of the losses which they sustained, to say nothing about the losses inflicted upon the public at large. When toll pikes in Kentucky were in public favor, the right of property in them was secure. When they come to be regarded as a "relic of barbarism," the courts were powerless to protect them.

Prior to the Civil War, many counties in Missouri issued bonds to subsidize the building of railways. The bond issues were loosely safeguarded, and some counties in which no railroad was built were saddled with a heavy debt. The people in these counties naturally opposed paying the interest and the principal of the debt, and went so far in some instances as to elect judges of the county court pledged not to make the necessary tax levy. The bond-holders accordingly sought a remedy at the hands of the federal court in Kansas City, Missouri. But in a number of counties public opinion was so set that the orders of the federal court directing the county judges to levy the necessary tax have repeatedly failed to command obedience. One of the accepted and well-understood duty of the judges in some counties has been a jail sentence for contempt of court. In some cases the judges have taken to the woods as soon as elected. The Supreme Court has held that a federal judge can not himself or through any official appointed by him make a tax levy. The utmost that can be done is to order a county official to levy the tax needed to pay a judgment, and to punish failure to comply

[4] Jesse F. Orton, "Confusion of Property with Privilege; Dartmouth College Case," *The Independent*, Vol. 67, 1909, pp. 392–97.

as contempt of court.[5] The upshot is that the decrees of the federal court have for years been in abeyance and the legal rights of the bondholders have not been enforced. This incident renders it more than doubtful whether the federal courts could have prevented a number of states from repudiating their debts even if the eleventh amendment had never been added to the constitution. In the words of Lincoln:

> In this and like communities, public sentiment is everything. With public sentiment, nothing can fail; without it nothing can succeed. Consequently he who moulds public sentiment goes deeper than he who enacts statutes or pronounces decisions. He makes statutes and decisions possible or impossible to be executed.[6]

If the status of public opinion sometimes paralyzes the activity of prosecuting attorneys and nullifies the decrees of courts, it also occasionally enforces a higher standard of business conduct than the law requires. Numberless oral agreements are every day faithfully observed which can not be enforced at law. Many a man's word is as good as his bond. Every social group has a code of honor which in some respects exceeds the letter of the law. Probably "Wall Street" suggests a low order of cunning to most minds, and yet there is not place where certain kinds of contracts are more scrupulously observed. The whole fabric of credit so essential to modern business rests upon men keeping faith, and is in the main quite independent of the compulsory processes of the courts. Justice secured by means of litigation is frequently so expensive that it comes too high. Throughout the silver controversy the members of the New York Clearing House steadfastly refrained from paying their daily balances in silver, though Congress required the Clearing House rule forbidding such payments to be rescinded.[7] During the Civil War, Massachusetts paid the interest on her bonds in gold, "though it cost her sometimes nearly three for one to keep her faith."[8] More noteworthy was the maintenance of the gold standard on the Pacific Slope. Legally debtors in California had as much right to tender greenbacks in full discharge of their debts as in any other part of the country, but the fact that a man could not tender greenbacks without injuring his credit and losing standing among business men effectually prevented such conduct. Self-interest resulted in a higher standard of business honor than the law demanded. In like manner competition at the present time frequently compels a higher standard of efficiency and honor among men than the law requires.

> It is difficult to see why any one with any practical experience of business should take the law of the matter as a guide. The law is a very cumbrous, slow

[5] I am indebted to the Dean of the University of Missouri for this information.

[6] "Debates of Lincoln and Douglas," *op. cit.*, p. 82.

[7] Horace White, "Money and Banking," fourth edition, p. 171.

[8] James Russell Lowell, "Prose Works, Essay on Democracy," Vol. 6, p. 11.

and inefficient machine for preventing robbery and other crimes on the part of rogues and burglars in the various forms in which they infest society. It makes no attempt to show how things should be done well. That is not its business. Any one who relies on the merely legal interpretation of his duties is only doing enough to keep him out of Wormwood Scrubs.[9]

Once more, when boast is made of the protection afforded private property by the courts, an important exception should be noted, namely, promissory notes. Congress has the right at any time to emit bills of credit and to declare them a legal tender in payment of pre-existing debts. The man who lends another one thousand dollars to-day is without any remedy at law if his debtor at the maturity of the loan tenders him depreciated paper money which Congress has clothed with legal tender power. In other words, a large class of property is in an important respect well outside the protection of the courts. The only remedy open to those opposed to debasing our monetary standard is political action. It was this remedy and this remedy alone that brought about the resumption of specie payments and subsequently prevented the free coinage of silver. Even if the final decision of the Supreme Court in the legal-tender cases had been adverse to the power of Congress to issue the greenback, a large portion of the community, including the great army of wage earners, would have suffered an irreparable loss before the decision was reached.

The property-owning interests dependent upon a protective tariff for their prosperity are in a position similar to the holders of promissory notes. The tariff schedules fixed by any Congress may be changed at any time without the slightest obligation to compensate those whose business interests are thereby disturbed. The courts can not be successfully invoked to stay the hands of Congress. Here as in the case of promissory notes the parties interested are limited to political action, and if the history of tariff legislation indicates anything it is that the remedy is more than adequate.

The case of the liquor traffic, a business in respect to which the police power of the state is subject to a minimum of restraint by the courts, illustrates the same point. The state may, if it deems wise, prohibit the manufacture and sale of intoxicating beverages without indemnifying any one for losses sustained. The liquor business is commonly regarded as disreputable. When run for profit, it is inconsistent with the public good and it is accordingly subjected to all sorts of restrictions. It is notorious that the business in many communities is conducted in flagrant disregard of law. Comparatively few states, however, go so far as to try to prohibit the traffic. In most communities the business flourishes and there is no lack of capital willing to assume the risks incidental to embarking in it. As in the case of protection, the

[9] Hartley Withers, "Stocks and Shares," p. 145.

political remedy is usually more than ample to safeguard the liquor interests.

II

The theory of judicial control in the American constitutional system entitles the courts to a certain eminence, but it does not justify magnifying the judiciary to the exclusion of everything else. The courts are but one of several restraining influences to which the members of our legislative bodies are subject. "Things in possession," says James Russell Lowell, "have a very firm grip. One of the strongest cements of society is the conviction of mankind that the state of things into which they are born is a part of the order of the universe, as natural, let us say, as that the sun should go round the earth."[10] The members of our legislatures are no more exempt from the play of this influence than is the mass of the people who elect them. The man who is obliged to listen to arguments on both sides of a question is apt to reflect a moderate point of view. Responsibility also exerts a sobering influence. Besides, in most states political parties are so evenly balanced that other men ambitious for office, within as well as without the party, can easily take advantage of any serious mistake of judgment. Once more, the mass of bills introduced at the recurring sessions of our legislatures is such that none save those that are vigorously pressed stand much show of enactment. The average member likes to be considered a practical man, and therefore looks askance upon the proposals of crank reformers. Finally, in a political contest, the property-owning class is very resourceful in taking care of itself. It can see to it that its claims are ably presented. It can pay for printers' ink. It can command the support of men of influence in the community. It can hire effective advocates and attorneys skilled in the labyrinthine processes of the law. It has great power of endurance as an antagonist. Property has a certain glamor which enables it to make friends in unexpected quarters.

Nor does the referendum promise to lead to such radical departures as many fear. There is a vast amount of inertia in the multitude which makes strongly for things as they are. The masses of the people may be more conservative than the average member of a legislature. For this reason certain organs of the Conservative party in England favor the referendum. It may prevent extremists from getting what they want by playing off one party against another. Many people are unwilling to take the trouble to inform themselves upon measures proposed for reform. Others talk like progressives, but lose heart when it comes to vote. Many working people are as much averse to shortening the working day as are the owners of factories. Parents bent upon exploiting their children are opposed to the interference of the law. The boys upon the anthracite coal breakers like their jobs. It is noteworthy that the ex-

[10] *Op. cit.*, p. 36.

tension of the ballot to women recently in Illinois was done by the legislature and not by a referendum. The gaining of "votes for women" may render the electorate still more cautious going. The historic function of women has been to conserve the old rather than to initiate the new. In any event, some opponents of woman suffrage favor submitting the question to the women of the several states as the most effective way to defeat it.

It is possible that the advocates rather than the opponents of the referendum will find more cause for disappointment at the result. The people of Oregon in 1910 and 1912 as compared with 1906 and 1908 showed a disposition to go somewhat slower in assenting to measures submitted for their approval. Out of thirty-two measures submitted in 1910, twenty-three failed to secure popular approval.[11] In 1912, twenty-six out of the thirty-seven measures submitted failed of adoption. Of the thirty-seven measures submitted, fourteen were proposed amendments to the constitution, only four of which were adopted. As the number of measures submitted has increased, the percentage adopted has fallen.[12] Of one hundred and sixteen constitutional amendments submitted to the voters of the several states during 1886–1891, sixty-two were rejected.[13] Of ninety-nine amendments submitted during 1894–'96, fifty-three were rejected.[14] Of eighty-eight constitutional questions submitted to the voters of Michigan during 1835–1908, thirty-nine failed of adoption.[15] In Massachusetts affirmative action has been more common. Of sixty amendments submitted since 1780, only nineteen have been rejected.[16] The experience in Switzerland has been that many progressive measures when submitted to the people have been defeated.[17] Its effects have not been radical or socialistic, neither has its tendency been progressive.[18]

Few writers eminent in the world of letters during the closing years of the nineteenth century were so impressed with the evils of democracy as Lecky. To his mind a wide suffrage meant government by the more ignorant portion of the community, political instability, successful appeals to class jealousies and antipathies by the demagogue, the spoliation of the rich by the poor. And yet Lecky was inclined to view the

[11] Ellis Paxson Oberholtzer, "The Referendum, Initiative and Recall in America," pp. 397–412.

[12] George H. Haynes, *Political Science Quarterly*, March, 1913, pp. 19 and 32.

[13] A. Lawrence Lowell, *op. cit.*, p. 170.

[14] Ellis Paxson Oberholtzer, *op. cit.*, p. 163.

[15] John A. Fairlie, "The Referendum and Initiative in Michigan," *The Annals of the American Academy of Political and Social Science*, Vol. 43, 1912, pp. 155–158.

[16] A. Lawrence Lowell, *op. cit.*, p. 171.

[17] Jeremiah W. Jenks, "Governmental Action for Social Welfare," p. 58.

[18] A. Lawrence Lowell, *op. cit.*, p. 168.

referendum with favor. By disentangling issues from one another, by freeing them from the dominion of party and from coalitions of log-rolling politicians, he thought the referendum might "prove the most powerful bulwark against violent and dishonest change." He even went so far as to say "that its tendencies might be towards extreme Conservatism."[19] One of the leaders of the Labor Party in England, Mr. J. Ramsay Macdonald, thinks the referendum will enable reactionaries to single out certain measures for defeat and to interfere with a consistent policy of reform.[20]

Judging from the amount and the character of the opposition which the referendum at present excites in the United States, one might suppose that it is nothing less than revolutionary in principle. Yet it involves nothing with which the country has not long been familiar. It squares with the traditional American theory that sovereignty resides in the people. In calling constitutional conventions and in adopting new constitutions it has long been employed in most of the states. It is the usual method of amending our organic law. In the decade ending with 1908, 472 constitutional questions, nearly all amendments, were submitted to the people of the several states.[21] The movement now well under way merely extends the use of the referendum to legislative acts. I can see no objection to such an extension that does not apply with as much force to the right of the people to determine their organic law. The latter is the more fundamental and logically includes the former. If the right of the people to pass upon legislative questions is dangerous to liberty and property, the right to pass upon constitutional questions is still more dangerous, unless surrounded by more careful safeguards. It is evident that the electorate *en masse* of a large population can not formulate the details of either their statutes or their constitutions. But if they are incapable of passing upon the public policy embodied in the former, neither are they capable of passing upon the general principles embodied in the latter. "The fact is," says Professor Burgess, "that the political science of the modern world is still engaged in the task of working out the distinctions between sovereignty and government, and that political practise is in the transition period between the sovereignty of the government and the sovereignty of the people behind the government."[22] Much of the opposition to the referendum can only be understood in the light of this remark.

The argument that the referendum will lower the character of our legislative bodies is of doubtful validity. This has not been the effect

[19] *Op. cit.*, pp. 22–34 and 276–294.

[20] A. Lawrence Lowell, *op. cit.*, p. 158.

[21] Ellis Paxson Oberholtzer, *op. cit.*, p. 477, quotes W. F. Dodd's work on "Revision and Amendment of State Constitutions" to this effect.

[22] *Political Science Quarterly*, Vol. 13, 1898, p. 203.

upon our constitutional conventions. The personnel of these conventions is far superior to that of our state legislatures. While many of the latter have gained a reputation as fountains of political debauchery and have declined in influence, the former have remained in high repute. A seat in a constitutional convention is still an honor.

> The best men in the community are still willing to serve in it, no matter at what cost to health or private affairs. I can not recall one convention which has incurred either odium or contempt. . . . In looking over the list of those who have figured in the conventions of the State of New York since the Revolution, one finds the name of nearly every man of weight and prominence; and few lay it down without thinking how happy we should be if we could secure such service for our ordinary legislative bodies.[23]

The demand for the referendum is the result of the deterioration which our state legislatures have already undergone.

Most of the objections to a larger measure of popular rule are merely notes of caution. The proper metes and bounds can only be determined in the light of further experience. In the mean time, it is the place of every intelligent man to keep an open mind. No plan of government is a finality. Our direct primary laws are still in the experimental stage. Some of them have been enacted by machine politicians with a view to discrediting them and are capable of great improvement. Even the fundamental guaranties of our federal and state constitutions need to be adapted to changing conditions either by interpretation or by formal amendment. The constitutional prohibition in Pennsylvania which prevents a law requiring wages to be paid in money may have once conserved the liberty of the individual, but such a prohibition to-day secures the form without the substance of liberty.[24] Whether a given guaranty is fundamental or not is a matter upon which there may easily be differences of opinion. To hold that constitutional guaranties are immutable and that the majority after due deliberation has not the moral right to change them is to take them outside the realm of reason and discussion.

On constitutional matters practically no one questions the referendum. On local matters, such as the liquor question, increasing the bonded debt of a city and granting franchises, where the issues are "simple and familiar to the voters," it has an acknowledged field of usefulness. The extension of the referendum to state-wide legislative acts is at the present time the bone of controversy. A century ago, however, the ratification of state constitutions by popular vote was viewed with similar misgivings. It was not till 1840 that this practise was generally recognized. At the outset, the state legislatures called

[23] Edwin L. Godkin, "Unforeseen Tendencies of Democracy," p. 142.

[24] William Draper Lewis, "A New Method of Constitutional Amendment by Popular Vote," *Annals of the American Academy of Political and Social Science*, Vol. 43, 1912, pp. 315–316.

constitutional conventions without any higher sanction.[25] The federal constitution was ratified by representatives of the people and not by popular vote. To-day, however, the ratification of amendments to the constitution by the legislatures of the several states is an anachronism. As applied to legislative acts, the referendum can have only a negative effect. As already noted, it frequently makes for things as they are rather than for needless change. A serious objection is that it may embarrass the conduct of public affairs by withholding necessary appropriations. The voters are sometimes penurious in voting the public money. On two occasions, appropriations for the state university in Oregon have been held up until approved by a referendum, the teaching staff in the meantime performing its duties without pay. Such experiences tend to repel efficient teachers. The educational advantage to the voters hardly compensates for the interference with efficiency. Such occurrences are, however, not a necessary feature of the referendum. In Ohio, "laws providing for tax levies, appropriations for the current expenses of the state government and state institutions," are not subject to the referendum. The legislature is also empowered to exempt "emergency laws necessary for the immediate preservation of the public peace, health or safety" from a referendum by a two-thirds vote. Similar provisions exist in many other states.

The small vote polled on constitutional and legislative referenda as compared with the vote for candidates often excites remark. Probably it indicates that many voters are more interested in men than measures. It also points to the fact that our political canvasses are largely contests between individuals seeking the emoluments of public office. Electioneering is so conducted as to arouse partisan zeal. The appetite of hungry spoilsmen aided by automobiles gets out a vote that is not particularly well informed. Moreover, referenda seldom get much newspaper notice. Except in Oregon, the voter is usually left entirely to his own devices to inform himself. Finally, referenda are overlooked by many voters because they occupy an inconspicuous place on the ballot. The vote cast upon such questions in Illinois has been greatly increased by placing them upon a separate ballot. A similar plan in Idaho has almost doubled the percentage of the total vote cast on constitutional amendments.[26]

In the opinion of some writers, the initiative is nothing less than revolutionary. "Of all the proposals that have been brought forward in the name of direct democracy, the initiative is the most preposterous

[25] Charles A. Beard and Birl E. Shultz, "Documents on the State-wide Initiative, Referendum and Recall," pp. 15–19.

[26] W. F. Dodd, "Some Considerations upon the State-wide Initiative and Referendum," *Annals of the American Academy of Political and Social Science*, Vol. 43, 1912, p. 213.

and the most vicious," remarks President Butler.[27] In view of the diverse forms which the initiative takes in the several states, this condemnation is altogether too sweeping. One's judgment should be governed by the concrete form which the initiative takes. In Oregon, a measure goes directly to the voters in the form in which it is initiated. In Ohio, it is first considered by the legislature. If not enacted into law within four months, or if passed in an amended form, it is submitted to the people in either its original or its amended form, provided a supplementary petition "signed by not less than three per centum of the electors in addition to those signing the original petition" is filed with the secretary of state. In Oregon, eight per cent. of the legal voters are required to initiate a measure; in Wyoming, the plan submitted to the voters in 1912 required twenty-five per cent. In Missouri, an initiative petition must be signed "by not more than eight per cent. of the voters in each of at least two thirds of the congressional districts in the State." The larger the population of a state the more difficult it is to secure the required number of petitioners. In Michigan, more than twenty per cent. of the voters "voting for secretary of state at the preceding election of such officer" are required to initiate a constitutional amendment. The petition must be signed at a regular registration or election place and the signatures must be verified by the registration or election officers. No amendment can be submitted to the people if the legislature disapproves. Finally, an affirmative vote of not less than one third of the highest vote cast at the election for any office is required to adopt such an amendment.[28] A movement that is marked by so many signs of caution offers little occasion for alarm to the owners of property.

A common objection to the referendum and the initiative is that they will destroy representative government. By a similar course of reasoning, namely, by excluding everything but one fact from the mental horizon, one might prove that the earth is destined soon to fall into the sun. I am not aware that the most radical advocates of direct democracy propose to do away with representative government. The yearly grist of legislation is so large as to render such a thing impossible. The chief object of direct democracy is to render our representatives more truly representative. If our legislative bodies were the deliberative bodies they are supposed to be, the demand for the referendum and the initiative would hardly have arisen. Many bills are originated by interests outside of the legislature and are rushed through in the closing days of the session without opportunity for amendment or debate. Instances of minority rule through laws enacted by a majority

[27] "Why Should We Change Our Form of Government," p. 25.

[28] Charles A. Beard and Birl E. Shultz, *op. cit.*, pp. 80, 203, 169, 178–179; Ellis Paxson Oberholtzer, *op. cit.*, p. 397; "The Constitution of the State of Ohio," published by Chas. H. Graves, Secretary of State, 1913.

of our legislative assemblies have not been uncommon. As a result, there has long been a tendency to shackle our legislatures with more stringent constitutional restrictions. Numerous statutory enactments have been written into the organic law of many of the states which the legislature can not change. Provisions in the statutes of some states are often found in the constitutions of other states. The referendum and the initiative are another device to prevent an abuse of legislative power.

President Woodrow Wilson says:

> Among the remedies proposed in recent years have been the initiative and referendum in the field of legislation and the recall in the field of administration. These measures are supposed to be characteristic of the most radical programs, and they are supposed to be meant to change the very character of our government. They have no such purpose. Their intention is to restore, not to destroy, representative government. . . . If we felt that we had genuine representative government in our state legislatures no one would propose the initiative or referendum in America. They are being proposed now as a means of bringing our representatives back to the consciousness that what they are bound in duty and in mere policy to do is to represent the sovereign people whom they profess to serve and not the private interests which creep into their counsels by way of machine orders and committee conferences. The most ardent and successful advocates of the initiative and referendum regard them as a sobering means of obtaining genuine representative action on the part of legislative bodies. They do not mean to set anything aside. They mean to restore and re-invigorate, rather.[29]

Our legislative bodies sometimes yield to the passions of the hour, but the cowardice and irresponsibility which lead to this result are to some extent induced by the fact that the courts may set aside what the legislature enacts. The contention that the referendum will lower the standing of our legislatures is open to question, but there can be no doubt that judicial control has promoted trifling on the part of our legislative bodies and undermined their authority. So long as the Interstate Commerce Commission was not clothed with the substance of power, the railways occasionally treated it with contempt by waiting to present their side of a controversy until it was taken up by the courts. In like manner, judicial control lessens the reliance of property owners upon political action and causes undue reliance upon the judiciary. It seems probable that many members of our legislatures would treat the railway interests with more consideration if they knew that legislative indiscretion would not have to run the gauntlet of the courts.

Notwithstanding the undermining influence of judicial control upon legislative authority, the railways have found political action by no means unavailing. It is notorious that the legislatures of many states have done the bidding of the railways in practically everything that has concerned the railway interest. Likewise, our municipal governments

[29] William Bennett Munro, "The Initiative, Referendum and Recall," pp. 87–88.

have frequently been dominated by the public service corporations. The story related of a member of the Pennsylvania legislature, who, on a certain occasion, moved that if the Pennsylvania railroad has no more business to transact, the legislature do now adjourn, is typical of a situation that has been more or less general. If the railway and other corporations have not always been treated fairly by the public, it has sometimes been because the corporations by pressing their advantage too far have brought about a revolt from corporate rule. A high financial authority, *The Commercial and Financial Chronicle,* seldom commends the tendency of government to interfere with business. It maintains that the railways have not been getting fair treatment at the hands of the Interstate Commerce Commission. But concerning state regulation of rates, it remarks:

> Immediately preceding the panic of 1907 the states were very active for a time in reducing rates, but as soon as railroad revenues commenced to fall off, the States began to see the logic of the situation and in most cases changed their policy. They desisted from further attacks on the railroads. The local newspapers came to the rescue and pointed out how seriously the railroads were suffering and how detrimental to the best interests of the State this was. Popular sentiment changed and attacks upon the railroads in large measure ceased. Thus it was demonstrated that, after all, the railroads had little to fear from State action.[30]

One of the important functions of corporations, according to Professor Burgess, is to save the people from paternalism by acting as a makeweight against the state.[31] There can be no doubt that corporations serve this purpose. By enabling individuals to combine their several resources and talents, they preempt a large field for individual enterprise which only the state would otherwise be equal to undertake. But it is an open question whether this will prove true in the long run, so strong is the political influence which corporations can bring to bear against the public interest. The problem of keeping corporate action within proper bounds is so difficult that the upshot may be that the state will be driven to take over certain industries and run them on its own account.

[30] June 14, 1913, p. 1657.

(*To be continued*)

[31] *Op. cit.,* pp. 203–204.

EUGENICS AND EUTHENICS[1]

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THE privilege of claiming your attention for a few minutes is doubtless given to me as a biologist, and I shall speak chiefly of the biological aspects of the subject, leaving to others to discuss its sociological aspects.

There are three phases of the problem of human betterment—culture, eugenics and evolution—and these need to be carefully distinguished. They are commonly confused in the minds of those who have given little thought to the biological aspects of the problem, and such confusion is likely to lead to misdirected effort. The biologist who makes no claim to be a sociologist may make a few suggestions to which the student of social problems may well give heed.

Human betterment may be secured through work for the relief of distress, through education of the individual, by inspiring him to action upon a higher moral plane. By the cumulative effects of such culture, generation after generation, great social advance may be made. It is by this method that our great advance in civilization has been secured. This is, of course, work of the greatest value, promoting profoundly human happiness and social progress. It needs no defense. It makes a strong natural appeal to every normal man. If effort for the comfort of domestic animals is recognized by us all as of worth, how much more must we approve all intelligent endeavor to advance human welfare. In nothing that I shall say would I wish to be interpreted as lacking in appreciation of and enthusiasm for such individual and social culture. Contributing to the happiness of one's family and neighbors, promotion of normal living among them, is a life motive worthy of any man, and when we realize that the betterment thus effected need not cease with the present generation, but may improve the social conditions under which all following generations shall live, this ideal becomes glorified.

But in all the centuries of known human history, while wonderful advance in individual conduct and social relations has been secured through the cumulative effect of the cultural effort that has been made, there has been little, if any, advancement in innate human character. There has been through all the centuries little, if any, improved inheritance for the race as a result of the many generations of culture. I have before written:

> We have no reason to believe that the progress in culture, secured by education in one generation, will directly improve the innate character of the chil-

[1] Presented before the National Conference on Race Betterment.

dren of the next generation. Were the effects of education inherited, human evolution should be rapid, but it has been slow; how slow perhaps few of us realize. We speak with pride of the advance of human civilization, of our progress in the arts and in useful knowledge, of the improvement in morals and the growth of altruism, and this all makes us blind to the fact that since the dawn of history there has been no clearly recognizable evolution of mankind. We reach larger results in the problem of life than did our progenitors five thousand years ago, but we are able to do so because we build upon their experience and that of all the generations between.

Have we much greater innate powers? Are we at birth endowed with characters having much higher possibilities and much higher tendencies physically, intellectually and morally? Have we to-day men of much greater physical prowess than the ancient conquerors of the world, than the builders who constructed the monuments of Egypt? Have we more adventurous spirits or more successful explorers than the Phœnicians, who without compass sailed the ancient seas, reaching the whole Atlantic coast of Europe and the British Isles, also passing southward even around the tip of Africa? Are there among us to-day men of keener inventive genius than the one who first used fire, or the inventor of the lever or of the wheel or than the man who first made bronze or smelted ore? Our modern engines have been invented screw by screw by successive builders, each building upon the others' work. Have we to-day men of much larger legal and social understanding than the ancient lawgivers who forged the legal systems which still are the basis of our most enlightened governments? Have we poets whose genius greatly transcends that of Homer, or of the authors of the books of Job and Ruth? In esthetic appreciation, and in the power of artistic expression in sculpture and architecture, we are degenerate compared with the Greeks.

Even in innate moral character have we greatly advanced? We are *learning the lesson* of altruism, but *are we born* with a sturdier moral sense? If we could take a hundred thousand infants from London or Chicago and, turning back the wheel of time, place them in the homes of ancient Babylon, would they reach a higher standard of righteousness or of altruism than their neighbors? How little evidence we have of real evolution of mankind since the first emergence of the race from the darkness of prehistoric times!

But though we accept the statement that innate human character can not be improved by the direct inheritance of the effects of culture, there still remains to us the eugenic method of procedure, which, if it can wisely be applied, may result in improvement in the stirp, in the real essential innate character. This is an ideal that fires the imagination—the breeding of a race that shall be strong and wholesome, physically, intellectually and morally; men who shall be decent because they are inherently decent, not because by training they restrain their evil tendencies; a race from whose fundamental character the evil tendencies are actually removed. This is a social ideal higher even than was apparently present to the mind of Jesus.

Is this ideal—of a race of inherently wholesome men—utterly chimerical, or is there a way of approaching it? No positive, indubitable answer can now be given to this question, for scientific study of heredity has not yet given us extensive knowledge of the biological, especially of the psychological phenomena of inheritance.

This second part of the problem of human betterment, real race betterment, is a problem of good breeding, not one of culture. This problem of good breeding has two somewhat distinct aspects that are seldom clearly distinguished. There is first the problem of bringing the race average nearer to its present best by eliminating the less desirable and breeding from the best. This is the problem of eugenics as ordinarily considered. But there is the added problem of securing further true evolution of the race, raising the present best to a better.

We see thus the three aspects of the problem of human betterment: first, human culture, whose effects are cumulative through training from generation to generation, though not inherited; second, race-betterment through breeding from the best and eliminating the more undesirable, thus raising the general average toward the best type of manhood as we know it; third, the problem of securing true evolution beyond the point of the best yet experienced among men.

The problem of human culture is social, not biological. The problems of eugenics and evolution are primarily biological, but can be approached only if social conditions allow the application of biological method. It is necessary to emphasize cultural effort, for it is essential that the good breeding of the future human race be in the midst of a controlling atmosphere of highest altruistic idealism. Let us note for a moment some elements of the biological problem.

I can not stop to describe the microscopical structure of germ cells and their nuclei; the fact that the nuclei contain chromosomes in definite number which are the instigators of physiological action and the controllers in heredity; that the chromosomes in each nucleus fall into diverse categories physiologically, there being two chromosomes of each physiological type, one derived from the male parent and one from the female parent; that the different regions of a single chromosome may have different physiological values, and that in the division of nuclei the chromosomes split in such a manner that each daughter cell receives half of each specialized bit of each chromosome; that before fertilization one chromosome of each physiological pair is thrown away, and that in fertilization the full double character of the nucleus is restored. Of course, without knowledge of these structures in the germ cells and of their behavior in reproduction, one is not ready to begin to think of problems of inheritance. Familiarity with these fundamental facts not only helps one to escape many errors into which so many of the uninitiated fall, as, for example, the belief in the inheritance of the effects of culture, that is, of acquired characters, but it is essential as a guide to every step of one's thinking in this field. But I must assume that these are familiar matters to you all.

Recent studies in heredity have demonstrated that there is a sharp distinction between qualities that are heritable and others that are not

heritable. We name the former stable characters, the latter unstable, or fluctuating characters. New qualities are arising from generation to generation through variation. These variations may similarly be classed as stable variations, or mutations, and fluctuating, or unstable, variations. No result can be reached by breeding with reference to unstable variations or qualities, for they are not inherited. Qualities belonging to the unstable type can not be fixed by breeding. They are, therefore, without significance in the problems of eugenics and evolution. It is impossible, however, to discern whether an observed quality is of the stable or unstable type until one follows its behavior in inheritance.

Another fact of the greatest importance to remember is that there is probably no such thing as inheritance of vague general resemblances, but that inheritance is apparently always particular, definite, so-called unit qualities being the things inherited. The character of any individual is built up of a complex multitude of such unit qualities, each heritable separately, and the character of an individual depends upon the combination and interaction of the unit qualities that have been passed down to him from his parents, grandparents and other progenitors.

In the light of these facts, what is the essential problem, first in eugenics, then in evolution? The eugenics problem is accurately to determine the desirable unit qualities, which must be of the stable type, and to combine and fix them in the race by breeding, eliminating at the same time the undesirable unit qualities. It is the problem of finding the exact units of inheritance, and of so fixing and combining, by breeding, these valuable units in the individuals of the coming generations that we shall have a more wholesome innate character in mankind. The evolution problem is to find among the multitude of diverse human traits *new* desirable unit qualities of the stable type, often only in their beginnings, and to perpetuate these by breeding.

The Galton-Pearson school of English students are willing to waive accurate analysis of inheritance units, but the real problem will not be solved until we know whether the human qualities with which we wish to deal, the intellectual and moral as well as the physical, do follow the Mendelian principles in inheritance, and until we have analyzed the Mendelian qualities to their units. We have a notable example of failure to secure permanent valuable results in attempting to breed from individuals whose valued character had not been analyzed to its unit qualities. At the Agricultural Experiment station in Orono, Maine, many years of effort were given to securing a strain of fowl which would lay an unusually large number of eggs. Mere breeding from hens which laid many eggs was not found to be enough. The quality of high fecundity could not be fixed in the strain. Selection had to be continued in each generation or reversion to the general average would

occur. It was only after Raymond Pearl's masterful experimental analysis of fecundity in fowls into its three physiological unit characters, and his combining of the three units into one individual, that it was possible to secure a strain in which high fecundity was a fixed character. In breeding humankind the manipulation of unanalyzed qualities might prove as futile as the earlier experiments at the University of Maine. On the other hand Burbank, in his breeding experiments, has reached some permanent results, though he has never scientifically analyzed into their units the desirable qualities he has succeeded in combining and fixing. But in each case he has dealt experimentally with many thousands of individuals and has reached success in but a small proportion of his attempts. His methods offer little chance of success in human breeding.

Even one wholly unfamiliar with the subject can see at once that the mere outlining of the biological problems of eugenics and evolution is wholly impossible in a limited paper such as this. Yet this very fact points the chief moral I wish to urge.

We are at the very beginning of our knowledge of heredity. Few of the myriad of unit qualities in mankind, or other animals, have been identified and defined. We know some, perhaps all, the units of hair color and eye color, we know some of the units of shape of hair, and a few other such comparatively simple qualities. But, as yet, we are merely entering the pass that opens on to the broad fields of knowledge of inheritance. We have analyzed a mere handful of the simpler physical unit qualities. We know nothing, as yet, of psychic unit qualities. We can not even be positive that the inheritance of psychic qualities is by definite units which follow the so-called Mendelian laws of inheritance. That intellectual qualities, and moral stamina, are heritable seems indicated, but the parallelism between their mode of inheritance and that of such a thing as hair color, however probable, is as yet not definitely demonstrated. It is possible that most psychic qualities are too complex ever to be sucessfully and completely resolved into their heritable units.

How much progress, then, may we hope for. We don't know, and we can not know, until we have had decades, perhaps centuries, of further study of these most intricate problems. By the biologist, trained through the study of evolution to think in geologic epochs rather than years, the dawn of a new day for mankind is foreseen. But to the sociologist, whose chief business is to apply our knowledge to present conditions, the whole subject is of much more limited interest. Aside from a few very limited aspects of negative practise of eugenics, the whole subject is, as yet, of little social significance. The prolonged labor of hundreds of special students is needed before this matter, which already is of the keenest biological interest, can become of the

greatest social moment. We must cultivate a little of the patience of God. It is perhaps unfortunate that so much attention from laymen is focused upon this great field of research. The man of science needs to work quietly, patiently, doggedly, without too much thought of so-called practical value to follow from his studies. He is painting the thing as he sees it for the God of things as they are, and he is fortunate, in a way, if he can find a separate star where he may work undisturbed by the too eager interest of the crowd who clamor to know the significance of each brush-stroke.

Shall we then attempt no practical application in eugenics of the little knowledge of inheritance which we have already attained? For myself, I am in doubt. A number of states are making laws for the sterilization of certain undesirable classes, and are making the enforcement of these laws subject to the "expert" advice of a board composed generally of physicians. As a matter of fact there are very few states in this union which have among their citizens men capable of exercising expert judgment in these matters, and these men are not physicians, but biologists engaged in studies of heredity. Furthermore, in but few individual instances are there genealogical inheritance records which can serve as the basis of such expert opinion.

One thing, however, of the greatest practical value we can do. We can promote in every possible way the gathering and safe filing of human inheritance records, which in the future will serve as the foundation of such practise of eugenics as shall prove wise and practical. I can in imagination see the day when the compilation of inheritance data for each citizen will be compulsory, and when the files of these records will be the most valued of all state documents; when no marriage license will be issued except after the most careful scrutiny of the inheritance records of each contracting party by trained students of inheritance; and when the state will debar from marriage those whose children will be a burden to the state. The bearing of children is, of course, not an individual right, but a social privilege, and in time it must come to be so recognized.

With eugenics as our goal, with a hope of ultimately greatly improving the fundamental character of the race, let us cultivate patience, allowing time for the sure grasp of the phenomena and relations in heredity, before attempting by law any but the most limited applications of its principles to human marriage. Let us promote the view that social welfare, not individual comfort, is the ultimate criterion in marriage, and meanwhile let us actively promote the gathering and preserving of inheritance records for *all* persons, thus providing data for intelligent practise of eugenics in coming generations. We can at once insist upon the gathering of such data for all persons in our state penal institutions, almshouses, hospitals, asylums, etc. I am told that the city

of Rochester is doing this with its public school children. We can urge the gathering of such data by privately controlled institutions of similar purpose. We can urge right-minded individuals everywhere to supply such data as to themselves and their families. But this will still fall far short of our need, for those who are contributing the most children to the coming generation will be the last voluntarily to supply the desired data. Nothing short of a state system of compulsory gathering of data for all individuals can serve as an adequate basis for such negative eugenics as it may in time be wise to enforce by law. But such compulsory gathering of data can not now be had. There must first be much education of general sentiment, and there must be trained students to take the records.

That observant naturalist, Oliver Herford, speaking in the supposed person of a crab, recently said:

> Be sure you are right
> Then go sideways for all you are worth.

I am asking for more time for the man of science to do his work before we insist upon applying too widely his results, lest in such application of uncertain scientific data we find ourselves making crab-like progress.

But I can not close with such a negative word. There are positive aspects of the matter which deserve the chief emphasis. Let me again urge that among the great needs must be recognized first scientific study of the principles of inheritance, and for this liberal financial support should be had; and second the cultivation of the realization that in marriage it is ignoble to seek the happiness only of the man and wife and to forget the character of the children and through them the welfare of society. Our poets and prophets, as well as our men of science, must open men's eyes to the beauty and worth of the social ideal in the family. Though we have advanced so short a way in the discovery of the phenomena and principles of inheritance, and though we have accurate inheritance tables for so few individuals, we can still clearly discern that marriage of certain individuals is unsocial. To what extent the state can now intervene to prevent such marriage is a question which needs careful detailed study, and is not an appropriate question for discussion in this brief general paper. But aside from this question of the limits of state action, we must emphasize the vital need of cultivation of the social point of view in this most vital of social institutions, the family, and the need now to gather the data upon which eugenics may in the future be based.

THE PSYCHOLOGICAL LIMIT OF EUGENICS

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THE rapidity with which the eugenic idea has spread is little short of wonderful, and its value can not be overestimated. However, this value has been not only and not chiefly for what it has claimed for heredity, but for the attention it has turned towards sanitation and hygiene.

This is a time of great social unrest and any panacea which offers to solve our problems is eagerly embraced. Eugenics has volunteered for the service, which accounts, in part, for its rapid spread. A second reason is its simplicity. Only one principle is required to dispose of all problems. In this connection Dr. C. A. L. Reed says:

> So vigorous, aggressive and all-pervading have become the demands upon the "science of being well born," that many have come wrongly to think that there is no problem other than heredity in the great problem of race culture.[1]

It is the object of this paper to show that even if a perfect eugenic system were in vogue, practically every social problem which we are now trying to solve would still remain, and I wish also to urge that in spite of what good it may have done, it has also done a very great harm in diverting attention from the really fundamental problems which underlie the question of race improvement.

The cocksureness of the eugenist is illustrated by the following quotation from Alexander Graham Bell:

> The individuals have the power to improve the race, but not the knowledge what to do. We students of genetics possess the knowledge but not the power; and the great hope lies in the dissemination of our knowledge among the people at large.[2]

In similar strain, but more comprehensive and more confident, we find Davenport saying in a magazine article:

> To the eugenist heredity stands as the one great hope of the human race, its savior from imbecility, poverty, disease, immorality.[3]

Let me quote further from Davenport's book, "Heredity in Relation to Eugenics."

> Man is an organism—an animal: and the laws of improvement of corn and of race horses hold true of him also. Unless people accept this simple truth and let it influence marriage selection, human progress will cease.[4]

[1] *Lancet-Clinic*, January 3, 1914.
[2] *Journal of Heredity*, January, 1914, Pl. 1.
[3] C. B. Davenport, Pop. Sci. Mo.
[4] P. 1.

Again:

> Perhaps the best definition of feeble-minded would be: "deficient in some socially important trait," and then the class would include also the sexually immoral, the criminalistic, those who can not control their use of narcotics, those who habitually tell lies by preference, and those who run away from home and school.[5]

Again:

> A settlement worker in New York City inquired into the meaning of a particularly unruly and criminalistic section of his territory and found that the offenders came from one village in Calabria known as the "home of brigands."[6]

The implication here is that the germ plasm in Calabria is bad. Finally, comparing the influence of the criminals who were sent to Virginia from England he says:

> Soon better blood crowded into Virginia to redeem the colony. Upon the execution of Charles I. a host of royalist refugees sought an asylum here and the immigration of this class continued even after the Restoration. By this means was enriched a germ plasm which easily developed such traits as good manners, high culture and the ability to lead in all social affairs—traits combined in a remarkable degree in the first families of Virginia.[7]

Please remember that I am not denying a great deal of good in this movement, but too little attention has been given to either psychology or sociology by the eugenists, and unjustifiable conclusions have been drawn. The vogue of these conclusions is likely to delay progress by putting our thinking back twenty years, since which time the sociologists have been patiently building up the data of social psychology.

After the theory of evolution had been pretty thoroughly understood, the Spencerian idea of its universal application was eagerly appropriated. It was simple and comprehensive. If we found a condition of social inferiority the explanation was, "a lower stage of evolution." A race was less enlightened and thus proved its biological inferiority. It was a fine case of reasoning *post hoc ergo propter hoc.* In my opinion the reasoning in the quotations I have just given is of the same sort. "A band of brigands, a bad heredity." No one would be more glad than the sociologist to find a simple explanation of social phenomena, but there is none, and, to the minds of most sociologists, I venture to say that, instead of being the one hope, eugenics barely touches the problem of fundamental race improvement, although it has a definite place.

In 1893 Huxley in his lecture on "Evolution and Ethics" sounded the warning against making too close connections between the physical and the social values. He said:

[5] P. 9.
[6] P. 183.
[7] P. 207.

> There is a fallacy . . . in the notion that because on the whole plants and animals have advanced in perfection of organization by means of the struggle for existence, and the consequent survival of the fittest, therefore, men in society, men as ethical beings, must look to the same process to help them towards perfection. . . . Social progress means a checking of the cosmic process at every step and the substitution for it of another, which may be called the ethical process; the end of which is not the survival of those who may happen to be the fittest (in the respect of the whole of the conditions which obtain), but of those who are ethically best.[8]

The eugenist would say that he is in full agreement with that statement, but he seems to think that the inheritance of these ethical qualities follows the same laws as the inheritance of biological qualities. Man may be bred for qualities just as the race horse is bred, but he may not then fit social conditions any better than a race horse fits plowing. It is of interest and biological value to discover the verification of Mendel's law in the inheritance of eye color and stature, but it has no more social significance than whether Mendel's giant or late peas tasted the better. Many of the other data collected belongs in the same class. They belong to the world of description, while good and bad belong to the world of appreciation and value and are subject to entirely different laws. This is the idea which no one seemed to understand, offered by Dr. Richard C. Cabot last fall at the meeting of the Society of Sanitary and Moral Prophylaxis, when he insisted that there is no necessary relation between "the rules of sanitation and the commands of morality."[9]

For purposes of argument I am willing to grant that imbecility and some diseases are sufficiently pathological to justify some eugenic measures, though some brief could be made for even the feeble minded, but every other one of Dr. Davenport's catalogue I will not grant. Consider some of them: "poverty, sexually immoral, criminalistic, those who can not control the use of narcotics, liars, and those who run away from home and school, good manners, high culture." A few of these may be related to imbeciles, but so far as they constitute social problems only a very small per cent. of them are the result of biological abnormality, and yet they represent conditions that seriously handicap race improvement.

Please keep this list in mind while we turn to another consideration. There are two technical terms in sociology which are gaining increased significance. They are *social control* and *mores*. The latter is one of the methods of the former. Mores was the word used by the late Professor Sumner, of Yale, to indicate the mental and moral environment into which a child is born and which he accepts as ultimate intellectual and moral authority. The widest variety of racial and social expressions must be explained by means of this post-natal psychological in-

[8] D. Appleton and Company, pp. 80, 81.

[9] See *The Survey*, October 25, 1913.

heritance. Professor Ames, of Chicago, indicates something of the process of its acquirement:

> Every human being, if he is to live at all, is, from infancy, surrounded and cared for by persons. These persons fit into and help constitute a social group. The child is nourished, sheltered, guided and disciplined by this human environment. All objects and influences are mediated by the persons near him. His very sensations are determined and modified by them.[10]

The old-time evolutionist and the modern eugenist alike make little of social control in their effort to make clear the biological control of social processes. To them environment is merely external.

Let us now turn briefly to the list quoted from Davenport: Poverty is a problem, but we may ask in the words of Professor Cooley, of Michigan:

> What shall we say of the doctrine very widely, though perhaps not very clearly, held that the poor are the "unfit" in course of elimination? . . . The truth is that poverty is unfitness, but in a social and not a biological sense. That is to say, it means that feeding, housing, family life, education and opportunity are below the standards that the social type calls for, and that their existence endangers the latter in a manner analogous to the presence of inferior cattle in a herd endangers the biological type. . . . But since the unfitness is social rather than biological, the method of elimination must also be social, namely, reform of housing and neighborhood conditions, improvement of the schools, public teaching of trades, abolition of child labor and the humanizing of industry.[11]

The subject of sexual immorality is absorbing our attention these days. Flexner says that it

> plainly is absurd to speak as if women took to prostitution simply because they were marked out for a vicious life by innate depravity or even forced into it by economic pressure.[12]

If this kind of immorality were inherent we should, according to their own confessions, begin with the elimination of the greatest moral teacher of the early church, St. Augustine, and the greatest stimulator of modern social ideals, Count Tolstoy. The sex mores of Russia to-day are very different from those of America, and from those of Tolstoy's youth, and from what they will be a generation hence, all without the slightest help from eugenics, solely by the psychic force of social control. To be sure a part of the prostitutes are feeble minded, but even they are prostitutes largely as a result of the mores of their group and the commercial demand for their services.

As to the criminalistic, Lombroso with great pains made an anthropological description of the criminalistic type, but scarcely a criminologist in Europe or America to-day accepts his conclusions, and the modern science of penology is based on the system of social control.

[10] *Psychological Bulletin*, VIII., p. 407.

[11] C. H. Cooley, "Social Organization," pp. 294, 296.

[12] Abraham Flexner, "Prostitution in Europe," quoted from *The Survey*, January 17, 1914.

The same is true of the use of narcotics. With the exception of the few diseased who need special care, drunkenness is the product of group mores. The most drunken people in the world are undoubtedly the husky Russian peasants.

When it comes to lying by preference, I fear that none of us would escape, though most of us have painfully learned another way, while our yellow newspaper reporters still remain.

And as for running away from home and school, we might say that every normal boy has the tendency, and there are excessive cases like that of Mr. S. S. McClure, who tells us in his autobiography that he barely escaped being a tramp, in spite of which fact he has done some things for race improvement.

We need no germ plasm to explain the difference between "the first families of Virginia" and the poor white trash. That is exactly the sort of thing that mores explain.

But there are much more fundamental obstacles to race progress than these, and I can see no way in which eugenics can help them. Such forces as social classes, race prejudice, industrial strife, the social and economic position of women, are psychological problems of fundamental importance.

Social classes are not born, they are made. In this connection Lester F. Ward, the leading American sociologist, said:

> A certain kind of inferiority of the lower classes to the upper is admitted. There is a physical inferiority and there is inferiority in intelligence. This last is not the same as intellectual inferiority. Their physical inferiority is due entirely to the conditions of existence. As a subject race, as slaves, as overworked laborers or artisans, as an indigent and underfed class, their physical development has been arrested and their bodies stunted. . . . Their unequal intelligence has nothing to do with their capacity for intelligence. Intelligence consists in that capacity together with the supply of information for it to expend itself upon. We see, therefore, that both kinds of inferiority of the lower classes are extraneous and artificial, not inherent and natural.[13]

And again in this same connection, showing the intimate relation of classes to improvement, he says that what we need is not more ability, but more opportunity, and he estimates that if the opportunity could be made for existing ability by the abolition of social classes, the increase in the efficiency of mankind would be at least a hundredfold.

It is hardly conceivable that the breeding of the race-horse type of man will accomplish such a multiplication. We have ability enough; we only need to pry loose what we have.

Race prejudice belongs in the same category as social classes. The existence of a race is primarily caused by accidental signs which serve for identification plus the prevailing attitude towards the people bearing the signs. As Professor Ross says:

[13] Publications of the American Sociological Society, pp. 7, 8.

"Race" is the cheap explanation tyros offer for any collective trait that they are too stupid or too lazy to trace to its origin in the physical environment, the social environment or historical conditions.[14]

In this discussion I would like to substitute "heredity" for "race" and let the quotation read:

"Heredity" is the cheap explanation tyros offer for any collective trait that they are too stupid or too lazy to trace to its origin in the physical environment, the social environment or historical conditions.

When in a Battle Creek restaurant I saw the sign "Colored Patronage not Desired," my sympathy for the Negro enabled me to feel something as he feels, and I can assure you that the depressing force of a public opinion that approves of such discrimination is more influential on the race expression than a very large variation in the germ plasm. W. E. B. DuBois has described this form from the inside in his "Souls of Black Folk" where he says:

They must perpetually discuss the Negro problem, must live, move, have their being in it, and interpret all else in its light or darkness. From the double life that every American Negro must live as a Negro and as an American, as swept on by the current of the twentieth century while struggling in the eddies of the fifteenth—from this must arise a powerful self-consciousness and a moral hesitancy which is almost fatal to self-confidence. . . . To-day the young Negro of the South who would succeed can not be frank and outspoken, but rather he is daily tempted to be silent and wary, politic and sly. . . . His real thoughts, his real aspirations must be guarded in whispers; he must not criticize, he must not complain. Patience and adroitness must, in these growing black youth, replace impulse, manliness and courage. . . . At the same time, through books and periodicals, discussions and lectures he is intellectually awakened. In the conflict, some sink, some rise."[15]

When we remember that more than ten per cent. of the population of the United States belong to this class, we can feel that human progress can not proceed without limit until we have modified our race mores. The sad thing about it is the popular view that the race question is to be explained on biological grounds, and that any race except that to which we have been born is on a lower stage of evolution. We condemn them without trial. Wherever there is white contact with Indians the whole attitude is permeated with the idea that there is no good Indian but a dead one, and their efforts to change their conditions always comes face to face with this prejudice. Much of our immigrant problem is of the same sort. We condemn them in toto, as the brigands of Calabria were condemned in the quotation given. Lord Byron expressed the force of other men's opinion when he said:

I made men think I was what I was not, and I became what they thought me.

We can not escape the great and unjustified discouragement that will come to those we suspect do not belong to the race-horse type. The door of hope is closed to them, while the race horses can not fail to get

[14] "Social Psychology," p. 3.

[15] "Souls of Black Folk," p. 203, McClurg, 1903.

a self-satisfied snobbishness that will make the discouraged plow horse stop in the middle of the furrow. In the same way, registered human pedigrees will inhibit the common stock from making its contribution.

The eugenists have a good deal to say about immigrants. Among the Polish immigrants in America we have a great disproportion of criminals. In the Cook County jail in Chicago they are altogether out of proportion to any other nationality, and the same thing is true in the Detroit House of Correction. The Bohemians, who belong to the same race stock and live in adjoining territory in Europe, have very few criminals, and in Austria there are fourteen cases of litigation among Poles to one among Bohemians. The Polish immigrants are 31.6 per cent. illiterate, and the Bohemians, 3 per cent. The Poles are probably the most devoted to the church and the Bohemians the most rabid free-thinkers of all our immigrants. The social problems arising from these facts have nothing whatever to do with biological inheritance.

Now let us consider the classic example of bad heredity, the Jukes family. Almost everything that is said about the Negro can also be said about them. They lived in New York in the nineteenth century, but they were not a part of it. They were socially ostracized, and built up mores among themselves that had no part in the current civilization. It is barely possible that they averaged mentally inferior to their more socialized neighbors, but the sociologist does not need the inheritance of base characteristics to explain their criminality, prostitution and poverty.

If eugenics succeeds in establishing in the popular mind the tremendous social value of heredity that it is trying to establish, it will overthrow a mass of valuable work of the last decade which has been pointing the way to a fundamental solution of many of our social problems. What if certain people do stand higher on the Binet tests than others; it is yet to be proved that that indicates elemental social value. Psycho-physical parallelism may prevail, but that does not necessarily include psycho-physico-social parallelism.

The position of women has been created in much the same way as races and classes. Alfred Russel Wallace in his last book, "Social Environment and Moral Progress," puts the cart in this eugenic matter where it belongs. He says that when social justice shall have been established and women are free to choose their mates without the artificial conditions that now prevail, then natural selection will take care of itself. I myself am convinced that as a move for race improvement, the equal suffrage of women, with the eventual consequent assumption of intellectual and moral responsibility and economic independence, would be infinitely more valuable than all the eugenic laboratories in the world.

We should use all the forces of science in dealing with pathological conditions, but an attempt at artificial selection of mental and moral characteristics is aiming in the wrong direction.

THE RACIAL ORIGIN OF SUCCESSFUL AMERICANS

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THE New York World Almanac and Encyclopedia for 1914 gives a table showing the commonest surnames at the present time in England and Wales, Scotland and Ireland, arranged in the order of their frequency, according to a compilation made by the London *Pall Mall Gazette,* also the fifty commonest names in the cities of New York, Chicago, Philadelphia and Boston specially compiled for the World Almanac. A person's last name is not always an indication of race or nationality, but the following names which are here arranged in their order of frequency as they occur in England and Wales certainly have a thoroughly English sound. Smith, Jones, Williams, Taylor, Davies, Brown, Thomas, Evans, Roberts, Johnson, Wilson, Robinson, Wright, Wood, Thompson, Hall, Green, Walker, Hughes, Edwards, Lewis, White, Turner, Jackson, Hill, Harris, Clark, Cooper, Harrison, Ward, Martin, Davis, Baker, Morris, James, King, Morgan, Allen, Moore, Parker, Clark, Cook, Price, Phillips, Shaw, Bennett, Lee, Watson, Griffiths, Carter.

In contrast to this list, the English-sounding names sink to perhaps less then ten per cent. in Ireland. Probably a large proportion of these Anglo-Saxon names belong to the Protestant Irish of Ulster county. The order of frequency for Ireland as a whole is Murphy, Kelly, Sullivan, Walsh, Smith, O'Brien, Bryne, Byrne, Connor, O'Neill, Reilly, Doyle, McCarthy, Gallagher, Doherty, Kennedy, Lynch, Murray, Quinn, Moore, McLaughlin, Carroll, Connolly, Daly, Connell, Wilson, Dunne, Brennan, Burke, Collins, Campbell, Clarke, Johnson, Hughes, Farrell, Fitzgerald, Brown, Martin, Maguire, Nolan, Flynn, Thompson, Callaghan, O'Donnell, Duffy, Mahony, Boyle, Healy, Shea, White. It seems that there are only about nine names of English origin out of these fifty and with the exception of Smith none are high in the list.

In New York City, Chicago, Philadelphia and Boston, the Irish, German, Scandinavian and Jewish elements are recognizable in Murphy, Kelly, Cohen, Levy, Cohn, etc. Immigration has been going on for a number of years, and we may ask to what extent these more recently arrived races have risen to positions of national importance or distinguished themselves in professional life. The compilation "Who's Who in America" endeavors to include, if not the best, at least "the best-known men and women of the United States." The standards of admission divide the eligibles into two classes (1) "those who are

COMMON NAMES IN AMERICAN CITIES AND NUMBER BEARING THE NAME IN "WHO'S WHO IN AMERICA," 1912–13.

New York City		Chicago		Philadelphia		Boston	
Smith	27	Johnson	4	Smith	7	Smith	8
Brown	13	Smith	7	Miller	4	Sullivan	1
Miller	16	Anderson	2	Brown	4	Murphy	1
Murphy	5	Miller	6	Jones	6	Brown	11
Meyer	3	Brown	6	Johnson	5	Johnson	3
Johnson	9	Peterson	0	Wilson	6	Clark	3
Kelly	4	Jones	2	Kelly	0	O'Brien	1
Cohen	1	Williams	3	Williams	4	McCarthy	0
Levy	1	Wilson	6	Taylor	5	White	2
Williams	13	Thompson	4	Davis	3	Davis	0
Jones	8	Olson	0	Moore	3	McDonald	0
Murry	2	Davis	4	Clark	2	Williams	6
Wilson	7	Ryan	0	Murphy	1	Jones	1
Clark	9	Clark	2	Thompson	1	Kelly	0
Sullivan	2	White	2	Dougherty	0	Hall	3
Martin	8	Kelly	2	Young	2	Taylor	2
White	13	Martin	2	White	6	Doherty	0
Davis	7	Moore	5	Martin	1	Wilson	1
O'Brien	1	Schmidt	0	Thomas	1	Kelly	0
Ryan	3	Sullivan	2	Campbell	1	Donovan	0
Moore	5	Meyer	2	Gallagher	0	Murray	1
Schmidt	0	Murphy	1	Robinson	1	Collins	0
Taylor	9	O'Brien	0	Myers	0	Robinson	1
Muller	1	Hansen	0	Scott	2	Moore	1
Thompson	7	Larsen	0	Anderson	0	Anderson	2
Anderson	4	Taylor	2	McLaughlin	0	Allen	5
Walsh	3	Walsh	0	Allen	0	Thompson	2
Harris	6	Young	3	Green	1	Hill	3
Reilly	0	Campbell	1	Fisher	2	Ryan	0
Campbell	1	Lewis	2	Walker	1	Miller	0
O'Connor	1	Mueller	0	Morris	4	McLaughlin	0
King	2	Baker	5	Stewart	1	Walsh	0
Lynch	3	Adams	3	Wright	1	Mahoney	0
McCarthy	0	McCarthy	0	Mitchell	3	Fitzgerald	1
Schneider	1	Hall	6	Murray	1	Young	0
Lewis	9	Jackson	2	Hughes	1	Parer	2
Ward	7	O'Connor	0	Lewis	3	Lynch	0
Young	6	Hill	4	Fox	2	Campbell	2
Robinson	5	Burke	1	O'Brien	0	Martin	0
Hall	13	Allen	1	King	0	Rogers	2
Brady	3	Olsen	0	Evans	0	Baker	1
Burke	2	Hoffman	0	Roberts	4	Foley	0
Morris	5	Green	1	Jackson	1	Wood	1
Collins	3	Murray	0	Harris	1	Stevens	1
Jackson	7	Lynch	0	Collins	0	Morse	5
Carroll	2	Becker	0	Snyder	1	Crowley	0
Allen	13	Peterson	0	Kennedy	0	Lewis	1
Hughes	0	Ward	2	Wood	4	Barry	0
Klein	2	Morris	2	Hall	0	Burke	0
Cohn	2	Schneider	0	Burns	0	Driscoll	0

selected on account of special prominence in creditable lines of effort, making them the subjects of extensive interest, inquiry or discussion in this country; and (2) those who are arbitrarily included on account of official position—civil, military, naval, religious, or educational." The arbitrary class embraces, without regard to notability or prominence in any other respect, the following: all members of congress; all governors of states, territories and island possessions of the United States now in office; all United States judges; all judges of state and territorial courts of highest appellate jurisdiction; members of the cabinet; federal department heads; all officers of the army above the rank of colonel, and all of the navy above the rank of captain; all American ambassadors and ministers plenipotentiary; heads of all the larger universities and colleges; members of the National Academy of Sciences, and of the National Academy of Design; heads of all the leading national societies devoted to educational and scientific aims; bishops and chief ecclesiastics of all the larger religious denominations in the United States; and those who are in like manner chosen because of their official relations and affiliations.

In the tables below I present the lists of the most frequent names in New York, Chicago, Philadelphia and Boston as drawn from the World Almanac for 1914, and opposite each, the number residing in each city who are included in the 1912–1913 edition of "Who's Who in America."

Other names of five or more of the same name in "Who's Who" residing in New York, but not included in the above, are Abbott, Adams, Alexander, Baker, Chapin, Clarke, Cooper, Curtis, Davis, Eaton, Fiske, Foster, Fuller, Gilbert, Greene, Holt, Johnston, Lawrence, Lee, Merrill, Mitchell, Morgan, Morse, Norton, Parsons, Perry, Phelps, Porter, Post, Putnam, Richards, Russell, Scott, Stokes, Thomas, Vanderbilt, Walker, Warren, Wood.

All these with the exception of Scott, which is a characteristic Scottish name, and Vanderbilt, which is Dutch, are characteristically English names. It would seem that the original Dutch element has not maintained itself in general leadership in New York. The English element has. I suspect that much of the concentrated eminence now in New York City is due to migration of New England strains from Connecticut and Massachusetts, which states I have already shown to lead in proportion to their population in all forms of creditable activity, and no matter what be the criterion of distinction.[1]

If these fifty commonest names in New York City are arranged in the order in which they are most common on the other side of the Atlantic, 19 of these names will fall to England and Wales, 8 to Scotland, 15 to Ireland, while 8 are characteristicly German or Jewish.

[1] "Historiometry as an Exact Science," *Science*, April 14, 1911.

The nineteen English furnish 168 in "Who's Who." The 8 Scotch 57, the 15 Irish 37, the 8 German or Jewish furnish only 11. Thus it appears that, while the Irish and Jewish element in New York may control politics and the wholesale and retail trade, they have not often risen to high positions.

In Chicago the German and particularly the Scandinavian elements naturally show themselves in the surnames. Smith is even outdone by Johnson (here probably to a large extent Scandinavian). Anderson beats Miller and Peterson beats Jones, Olson is commoner than Davis and appears again as Olsen. Irish names are fairly common, Jewish names are not. The names not of English origin in the above list furnish 12 distinguished Chicagoans against 80 with characteristically English names. Other names of Chicago people occurring in "Who's Who in America" in blocks of four or more are Webster, Black, Carpenter, Cole, Evans, McCormick, Mathews and Stone. Not a single foreign name occurs frequently. Crediting each common name in Chicago to the European country in which it is most common and leaving out Johnson and Anderson as doubtful cases, the distribution and number in "Who's Who" is as follows: 18 English names furnish 59 distinguished individuals; 7 Scotch 24; 11 Irish 11. The 12 Germans, Jewish, Scandinavian or other common names furnish none!

In Philadelphia (of the 50 commonest names) 32 characteristically English names total 86 distinguished persons, 18 non-English total only 7. Crediting each common name to the "Old Country" in which it is most common, we find the distribution is England and Wales 28 names with 45 in "Who's Who in America." Scotland 11 names with 18; Ireland 9 with 4, and 2 other countries with 1.

For Boston the facts are a little startling. It seems almost unbelievable that the Irish making up more than half the population of the city, many of whom represent the second and third generation (for the Irish began to come to Boston in large numbers as early as 1830), can furnish only about two dozen persons entitled to national recognition.

According to "Who's Who in America" there were no persons in Boston entitled to inclusion, at the beginning of the year 1912 bearing the most common names of McCarthy, Davis, McDonald, Kelly, Doherty, Kelley, Donovan, Collins, Ryan, Miller, McLaughlin, Walsh, Mahoney, Young, Lynch, Martin, Foley, Crowley, Barry, Burke and Driscoll. Four of these names are Anglo-Saxon in origin, 3 are common to both the Scotch and Irish and 14 are essentially Celtic. Among the 50 commonest names in Boston found in "Who's Who," those of Anglo-Saxon origin total 64 distinguished representives, those of Celtic only 5. There should be about the same number of Anglo-Saxon and of Celtic since 20 of these common Boston names are Celtic to 26

Anglo-Saxon and about half the present population is Catholic Irish. Looking at the matter another way and crediting all of each name to that country of origin in which the name occurs most frequently, or highest in the *Pall Mall Gazette* list, we find England and Wales 21 names credited with 55; Scotland 8 names credited with 14; Ireland 21 names credited with 5 distinguished, or more strictly speaking, widely-known Americans now residents of Boston.

It is true that people of non-English origin often change their names, making them more attractive to American ears, a Schneider becomes a Taylor, a Weiss a White, or even a Solomon Levi may become a Sydney Lee. But I do not believe that such changes can have had any appreciable effect on the present investigation and none at all on the conclusions. I do not believe that more than a very small proportion of these persons in "Who's Who in America" who have English names have acquired their names in any other way than by natural descent. For the Boston statistics, I have been able to test this question by personal knowledge of the individuals or from genealogical inquiries. I know of two cases of notable foreigners bearing English names, one a Portuguese and one a Jew; but out of the 851 Bostonians in "Who's Who," I am very sure that not five per cent., probably not one per cent., have English names by change from a foreign one. I have made a special test of the Boston names and find out of 851 persons, that (bearing in mind the possibility of slight further readjustments) they must be classified as 19 Irish, 10 North Irish, 30 various European names and doubtful cases and 786 of true English or Scotch origin.

Thus to summarize: In the 4 leading American cities, New York, Chicago, Philadelphia and Boston, it is safe to say that, at the present time, those of English and Scotch ancestry are distinctly in possession of the leading positions at least from the standpoint of being widely known, and that, in proportion to their number, the Anglo-Saxons are from 3 to 10 times as likely as are the other races to achieve positions of national distinction.[2]

The cities contain most of the foreign elements. The cities are also the concentration points for most types of ability. They are also the breeding grounds of future leaders.[3] Therefore this study of the

[2] It is not possible to express this ratio accurately without a great deal of labor. Since the commonest names of all, Smith, Brown, Miller, Johnson, Sullivan, etc., are, on the whole, more English than foreign, all names can not be given the same weight. It would be necessary to go through the directories, count the names, and thus get the separate weights for each name.

[3] See F. A. Woods, "City Boys *versus* Country Boys," *Science*, April 9, 1909; and "The Birthplaces of Leading Americans, and the Question of Heredity." Mr. Spillman's side of the case should also be read, though his statistics seem to me to be meager. Galton for English scientists and Odin for French *littérateurs* have both found city-birth predominant.

4 cities ought to suffice to throw light on a number of important questions.

The truth of the matter is that all the stocks that have come into America in recent years since 1830 have been very inferior to those already here in the seventeenth and eighteenth centuries; and in general they have been getting worse and worse. There have been a few notable exceptions, but broadly speaking all our very capable men of the present day have been engendered from the Anglo-Saxon element already here before the beginning of the nineteenth century. We sometimes read magazines and newspaper articles about the Irish in America, the Germans in America, the French in America, the Jews in America, describing the achievements of distinguished foreigners who have risen to high esteem and publishing portraits of the same. It is because they are relatively few that it is possible to make a magazine article out of the material. Who ever saw a similar article on the English in America? The statistically true can be exciting only to the scientifically inclined.

We have heard a great deal about the Melting-Pot, but no one as far as I know has brought forward any proof that there is a Melting-Pot in true biological sense, *i. e.*, that there is any genuine mingling of blood sufficient to overcome the natural tendency that all species and varieties have to grow apart and become more dissimilar in course of time. If there had been a thorough mingling of the races in this country, there would have already been a decline in natural ability, but the tendency of like to mate with like, the natural tendency of the most successful to mate among themselves, works in the opposite direction. The real strength of a country is so dependent on the qualities of its leaders that it behooves patriots, sociologists and philosophers to take all these questions into account and consider more carefully the genesis and significance of that small fraction of one per cent. which represents the intellectual crust.

DARWIN AND WALLACE ON SEXUAL SELECTION AND WARNING COLORATION

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IN looking over the life of Wallace recently, my attention was again drawn to the differences in opinion existing between Darwin and himself, with reference to sexual selection. Wallace objected to Darwin's assumption that a bright or peculiar color or a peculiar note or call would attract the attention of other individuals of the same species but of the opposite sex, on the ground that such a process could not become operative in forms which did not have sufficient intelligence to discriminate, and hence could not explain the occurrence of such characters in the lower forms. And if the plaint of the eugenists be accepted at its face value, the degree of intelligence even in the human subject to-day is not sufficient to insure discrimination in choosing a mate.

The development of our knowledge of animal behavior, on the one hand, and the advances in our knowledge of the nervous system, on the other, appear to me to make possible a reconsideration of the matter from the point of view of one or the other of these two lines of work at the present time. It must not be supposed that the approach from this angle will settle the question quite independently of other considerations, but such a method of approach may adduce some independent probability of the soundness or unsoundness of Darwin's point of view.

In the first place, sexual selection with reference to color of coat or plumage or of song is dependent upon the existence of a particular group of sense organs capable of perceiving objects at a distance—the distance receptors as Sherrington[1] calls them. These are the eye and the ear and the olfactory organ. The perception of color and voice depends therefore upon the development of the eye and the ear. Sexual selection with reference to these two characters can not be operative, therefore, in forms not able to see or hear.

It is evident that any other process of selection that is dependent upon coloration, even including protective coloration under certain conditions, must be considered from the same point of view. We may, therefore, discuss the subjects of colors of flowers as a means of attracting bees, warning coloration, protection by mimicry, and certain phases

[1] Sherrington, "Integrative Action of the Nervous System," New York, 1906.

of protective coloration in connection with sexual selection, since it is clear that the same objection, namely, the need of intelligence, may be urged against the assumption of warning coloration. And warning coloration is effective against some animals with distance receptors, but not necessarily against animals without such sense organs.

Visual and auditory mechanisms make their appearance well down in the animal scale, and hence the possibility of reactions through these mechanisms also arises rather low in the scale. The question then shifts to the central nervous system, and we must inquire whether in any of the lower forms, before the onset of intelligence, reactions to color are possible.

Since the work of Sumner[2] on the change of color pattern in flounders when placed in an aquarium with a certain color pattern in the bottom, we have known that reactions to color do occur under certain conditions. There are, of course, certain limitations to the process, and the mechanism of the response may still require investigation, but the response of the fish to visual impressions is undoubted, and it would be a far cry to postulate intelligence in the process. If a flounder responds to changes in the color pattern of the bottom of an aquarium, it is apparently not a more serious offense to postulate a response to a peculiar color pattern in another flounder. Other observations of the same kind on other animals lead to similar conclusions with regard to response to color. In the terminology of the physiologist, the response is a reflex process, involving an afferent or sensory impulse, the mediation of the central nervous system, and some efferent or outgoing nervous channel to the pigment cells of the skin. The medieval debate as to whether a reflex must always occur through the spinal cord, or even through the palæencephalon[3] is quite beside the point.

Another instance in which the appeal of color or odor is of importance is the attraction of bees and insects generally by flowers. The debate on the color vision of bees is far from closed, but that color plays some rôle will probably be admitted without prolonged argument. Whether bees have a sense of smell may perhaps be an open question, but that flowers attract bees seems clear. Both flower and insect visitor often have developed extraordinary modifications of the primitive type of structures so that neither insect nor flower can get along without the other. The yucca plant and the Pronuba moth constitute a case in point. Often but one species of insect can fertilize a particular flower, and it may happen that an insect can successfully visit but one species of flower. The question is not so much how the insect knows enough to visit that particular flower, but what particular features of the flower appeal to specific sense organs of the insect.

[2] Sumner, *Journal of Experimental Zoology*, 1911, X., pp. 409–479.

[3] Edinger, *Journal of Comparative Neurology*, 1908, XVIII., pp. 437–457.

In warning coloration or terrifying attitudes, nothing can be warned or terrified which does not see the warning or terrifying individual. The only question that arises is again whether the warned or terrified one must be possessed of sufficient intelligence to think the matter over and decide according to the evidence presented to it by the visual mechanism or whether it merely obeys the first impulse. Wallace himself proposed this theory of warning coloration, and it must stand or fall on purely theoretical grounds along with the theory of sexual selection, postulating, as it does, the same mechanisms in the warned individual that Darwin's hypothesis postulates in the attracted individual. There is, however, more direct observational evidence in favor of warning coloration than there is in favor of sexual selection. Birds, as Wallace showed, are warned by certain colors of butterflies.

Whitman's[4] observations on pigeons show that their responses and reactions are in many cases purely instinctive, being elicited without previous education or experience, and occur only when the group of conditions is right. Instinct, to me, at least, means a definite response to a definite group of afferent impulses. The afferent impulses once set up, the response of the central nervous system is the same under the same conditions. As Whitman expressed it, "organization shapes behavior," a statement directly in line with Hermann's law of specific response to stimulation. And from this statement of Whitman's dates the transition of the discussion of animal behavior in metaphysical terms to its discussion in terms of biological entities. In animal behavior, organization centers largely, though not wholly,[5] around the central nervous system and its associated afferent and efferent channels and sense organs. Internal secretions of various ductless glands of the body, and afferent nervous impulses from certain of these various glands are, of course, to be considered in animal behavior, and all of them have their influence on the instinctive responses of animals at various seasons of the year. Yet all these things are to be considered as a part of the organization of the individual at any one time. And the conviction is slowly growing, in my own mind, at least, that it is not so much a single afferent impulse as it is groups of afferent impulses that determine the reactions of animals. A few illustrations will make this point clearer.

Hunger has been shown to be associated with definitive movements of the stomach in man, and hence with definitive afferent impulses from the stomach.[5a] In the wider sense of the term, hunger is of reflex origin. The feeding reactions of the newly hatched *Necturus* are accurately and certainly elicited when the animal is hungry, as Whitman showed, but

[4] Whitman, "Animal Behavior," Marine Biological Lectures, 1898.

[5] Pike, *Quarterly Journal of Experimental Physiology*, 1913, VII., pp. 22–26.

[5a] Cannon, Harvey Lectures for 1911–12, pp. 130–152, Philadelphia.

not when the hunger is satisfied. There has been much debate as to why the animal no longer responds as well to the sight of food held in a certain position after its hunger is satisfied as before. It would seem sufficient to remember that the afferent impulses coming from a full stomach differ greatly from the afferent impulses coming from an empty one; and it is not, in my opinion, necessary to postulate a mysterious psychical change, of obscure origin, in the animal to explain its failure to take food after its hunger is satisfied. While all the external conditions may be the same, the afferent impulses from the stomach, and hence the group of afferent impulses concerned in the feeding response, is changed after hunger is satisfied. Two different groups of impulses, although they may have certain impulses in common, are not necessarily integrated to the same motor response.

The "Geschlechtstrieb" is similarly associated with a particular group of afferent impulses, dependent from their origin, among other things, upon changes in internal secretions, and changes in the circulatory conditions in particular local regions. A review of the various influences operative in exciting sexual desire of higher animals is found in a paper by von Bechterew,[6] and the argument need not be pursued at length here. Sufficient has been said to show that both the feeding and the sexual act have their driving force in particular groups of afferent impulses, some of which are of internal (proprioceptive or interoceptive) origin. The state of hunger or of sexual desire once established, the consummation of either the feeding or the sexual act is dependent upon external conditions which may be more or less fortuitous. The sight of food when the animal is hungry is an incitement to take food. If the sight of a peculiarly colored butterfly warns the bird, we will say, against taking it as food, we have the afferent impulses of internal and of external origin acting in opposition, and it will readily be seen that if the color of the butterfly is to protect it, that color must convey a very strong stimulus to the bird.

In the case of the sexual act, the conditions under which Darwin imagined that pleasing song or beauty of plumage might be operative are somewhat different. The female is ready for the sexual act, and awaits the coming of the male. To the internal stimuli, there may conceivably be added an external group in the nature of a color pattern that attracts her attention or a song that mingles with the mood or more properly, with the group of other afferent impulses, and the addition of these simple elements, not necessarily powerful in themselves, may be just sufficient to turn the balance in the favor of the male possessing them. In the case of warning coloration, the warning color must act as a powerful deterrent agent, but in the case of a bright plumage or a pleasing song, both external and internal stimuli work together.

[6] Bechterew, *Archiv für Physiologie* (Englemann's), 1905, p. 524.

Nor can it be held that warning coloration depends upon the intelligence of the warned individual. Certain mimic butterflies may have only a superficial resemblance to each other, but the resemblance is sufficiently close to save the mimic from attack by the animals which spare the mimicked forms. Birds are not close critics or students of certain types of color patterns. A more critical observer would not be so easily deceived.

These considerations are wholly independent of the origin of mimicry. Conceivably, there have been cases arising in nature in which one species has developed certain characters which render it unfit for food; and another species, which may develop a color pattern similar to that of the noxious form, has been spared because of this resemblance. But all cases of supposed mimicry are not necessarily of this sort. As Eigenmann[7] has shown, many cases which might, under other conditions, have passed for mimicry are really cases of convergent or parallel evolution, the similarities arising from similar responses of different organisms to the same or similar features of the environment. Indeed, Eigenmann's position seems especially strong, since he is able to supplant the hypothesis of mimicry, wherever it is weak, by the more general theory of natural selection. But the essential point to be kept in mind in this connection is that, no matter how the resemblances may have arisen, if mimicry protects at all, the mimic escapes because of the lack of a keenly critical faculty in the pursuer.

An animal of a low grade of intelligence is more apt to show uniformity of deportment than an animal of a higher grade. The frog has never rivaled either the serpent's or the owl's reputation, possibly undeserved, for wisdom, but it reacts to a red rag with avidity. A really intelligent animal would not be so easily humbugged. A contraption of feathers, gay colors and steel wire will lure a trout from his pool, often to his sorrow, but the deception in the hands of competent deceivers proceeds from year to year. Any skillful angler will verify the statement that it is the trifling things which are of importance in the pursuit of fish. The catfish is more prosaic and demands more of the reality in the form of worms, not being satisfied with the mere semblance of food.

The arguments which apply to warning coloration apply equally well to sexual selection, and it is clear from what has been said that neither sexual selection nor warning coloration require any great amount of intelligence on the part of the warned individuals or the pleased ones. Indeed, it is conceivable that both processes might act more strongly in animals which were not too intelligent. In man, financial, social and family considerations often outweigh the more natural considerations.

[7] Eigenmann, *Annals of the Carnegie Museum*, 1909–10, VI., pp. 4–54, and later papers.

Arguments of this kind can not, of course, lead to a definite settlement of the question of the potency of sexual selection, but they appear to increase the probability that sexual selection may be a reality, and a more potent agent in evolution than we have realized or been inclined to admit. Many peculiar characters have a function that is at present unknown, and many of these unknowns have been supposed to act as factors in sexual selection. More accurate observation has, however, shown their true use in the animal's activities. The horns of the *Orocytes rhinoceros,* recently described by Doane[8] afford an example of a character, once supposed to be effective in sexual selection, which has proved to be of direct use to the animal in getting its food, and hence, an agent in natural selection. Undoubtedly, further studies of animals and plants in their natural environment will lead to still further instances in which characters apparently useless, so far as their relation to getting food or resisting enemies goes, will prove to have some direct use in the life of the animal or plant. Even at present, characters supposed to be active through sexual selection alone should be scrutinized with some care before their case is admitted to serious consideration.

The view that the secondary sexual characters are the expression of internal metabolic changes, internal secretions, and the like, does not exclude a selective value. Darwin did not explain the origin of such variations, but supposed that they might be of selective value, and if secondary sexual characters are related to the activity of organs of internal secretion, such an occurrence need not disturb us. Physiologists generally regard all an organism's responses as due to an interaction of internal and external factors, and some such similar relationship is probably at the bottom of orthogenesis. As I hope to point out in a later paper, there is much evidence of a chemical nature in favor of orthogenesis.

It is true that external characters or purely morphological characters such as muscles and bones have, heretofore, formed the greater part of the subject matter of discussions on evolution. But the idea of the potency of internal functional factors in evolution has crept in, and Gaskell has pointed out that two general kinds of mechanisms of internal coordination—the nervous and the chemical—have been concerned in evolution. Both kinds of mechanisms are of selective value. Regarding lactation as a secondary sexual character, great changes in such a character, dependent partly upon morphological, but largely upon chemical organization, have been brought about in the various breeds of dairy cattle by artificial selection. And in this domain of the heredity of chemical characteristics lies a whole field of experiment on characters susceptible of accurate quantitative measurement as yet barely touched by the hand of the Mendelian.

[8] *Science,* 1913, N. S., XXXVIII., p. 883.

It is a truth that loses none of its force by repetition that in laboratory observation of animals, the laboratory conditions do not always accurately represent the conditions in nature, and that the deportment of an animal in the laboratory may not be exactly the same as its deportment in nature. The failure of some relatively high animals to breed in captivity is a case in point, and this again calls attention to the importance of a group of afferent impulses rather than a single impulse in determining the response of animals. Some subtle influence of the natural environment is lacking in the conditions obtaining in captivity, and the normal deportment of the animals is modified in at least one important detail. Other animals have a nervous system of sufficient plasticity to adjust themselves to the changed conditions of the laboratory or zoological garden. But the laboratory experimenter is now, and will be for some time to come, dependent upon the data of close and accurate observers of animal life in the field for his basis of comparison. And until the laboratory worker is certain that the deportment observed in the laboratory corresponds to that in nature, his analysis is not biologically accurate.

It is probably true, as Professor Cockerell[9] suggests, that no man will ever be able accurately to tell the complete story of Wallace's life work, even on its biological side alone, using the word in its widest sense. It is an evidence of the genius of Darwin and of Wallace that each was able to get such a fundamental grasp of the phenomena of nature as to afford problems for workers in other lines apparently far removed from their own. The experimental physiologist has had relatively little to say in regard to evolution as yet, and is perhaps in no position to settle dogmatically any particular problem now. But physiology has a direct contribution of interest to the worker in certain phases of a much wider problem. Specialties multiply, new and confusing terminologies develop, and the point of view ever tends to become narrow. Biologists pursuing one specialty have more and more difficulty in communicating to biologists in other lines of work, the particular results in their own. And biologists are almost unintelligible to workers in physics and chemistry. Yet science is a unit, and there can be no lasting truth developed in one field unless it is in accord with truth in every other field. The task of finding out what other workers have to offer us is a huge and even insuperable one under present conditions. Some hope of relief may be held out when the biologists get some of their great generalizations reduced to simpler form, and consequently intelligible to the scientific multitude. At present, the theory of evolution seems to be the most promising common meeting place to which biologists in all lines of work may bring their contributions for the judgment and criticism of their brother workers.

[9] *Science*, 1913, N. S., XXXVIII., p. 871.

In fact, it seems as if Darwin and Wallace, Nägeli, Haeckel, Dohrn, Weismann, De Vries and a host of other investigators, had grappled with an all-embracing problem—a problem of problems that must engage the best energies of all the sciences for centuries yet to come.[10]

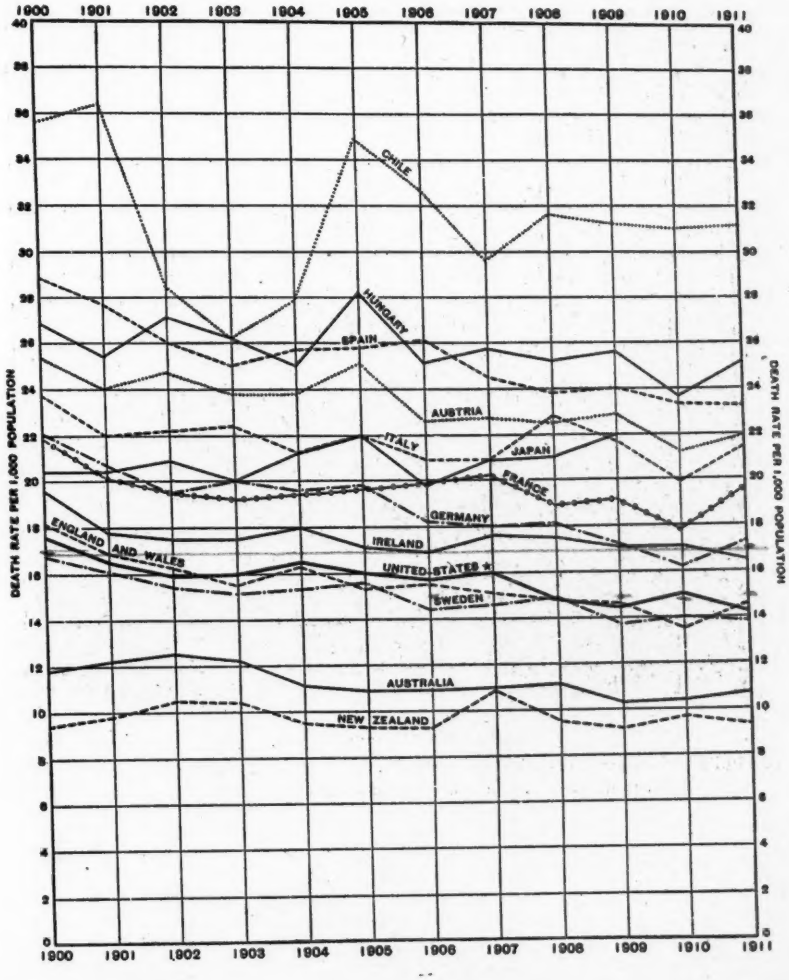
It is a striking evidence of the slight degree to which our subjects have been developed that we are so often blind to the general implications of our work, and the need for help from every conceivable quarter was never greater than now. The opportunity to acknowledge the influence of the great group of English biologists—Darwin, Huxley and Wallace, who showed that evolution of some kind and through some agency was a fact—upon my own line of work in an apparently distantly related field is a particularly grateful one. And it is more in the hope of directing attention to the tremendous breadth of the problem than of emphasizing any particular views of my own that this article is written. And if what I say may direct the attention of any other worker, in an apparently far removed and exceedingly specialized line, to what he may have to offer on the great problem of evolution in general, it will be well.

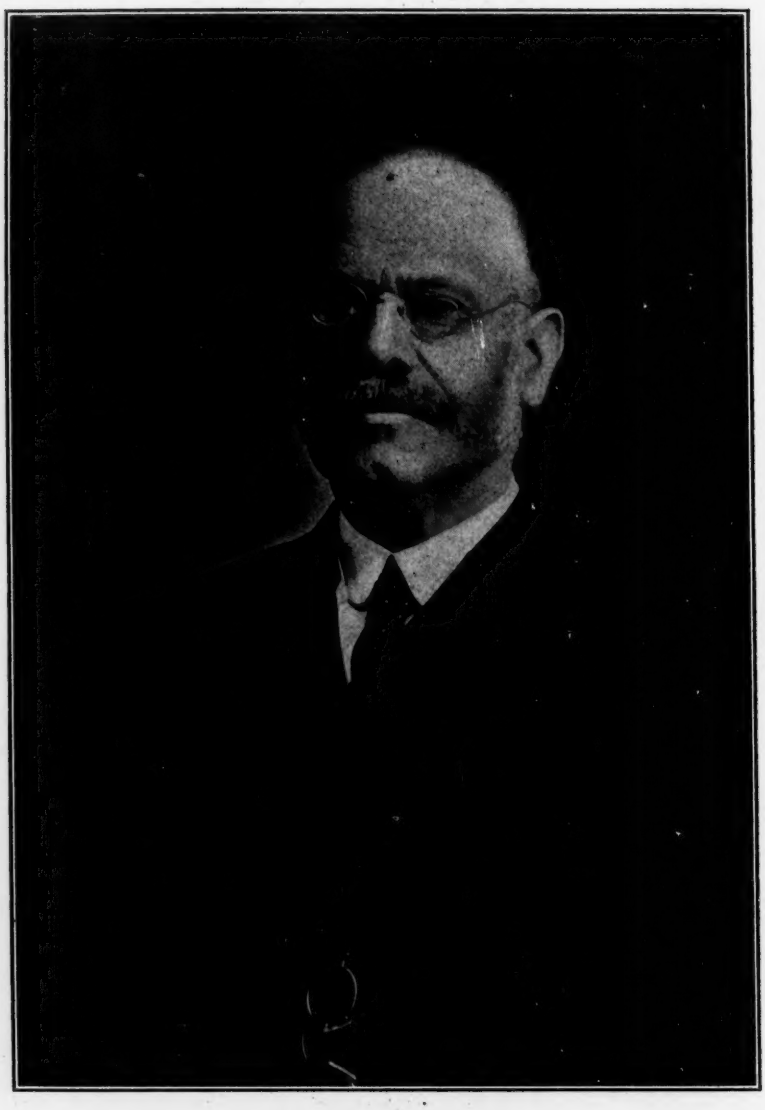
[10] Whitman, *Bulletin of the Wisconsin Natural History Society*, New Series, 1907, V., p. 6.

THE PROGRESS OF SCIENCE

MORTALITY STATISTICS OF THE UNITED STATES

THE Bureau of the Census has published its thirteenth annual report on mortality statistics, this report for 1912 following closely on that for 1911. The death rate in the registration area, which now includes about two thirds of the population, fell from 14.2 for each thousand of the population in 1911 to 13.9 in 1912. There are always fluctuations in the death rate due to weather conditions, epidemics, etc., but, as shown in the chart taken from the report, the death rate has steadily decreased from 17.6 in 1900. This means that in so short a period the saving of human lives in this country amounts to about 350,000 a year, a statement which it is difficult to appreciate at its true magnitude. In 1880 the death rate was 19.8. If we





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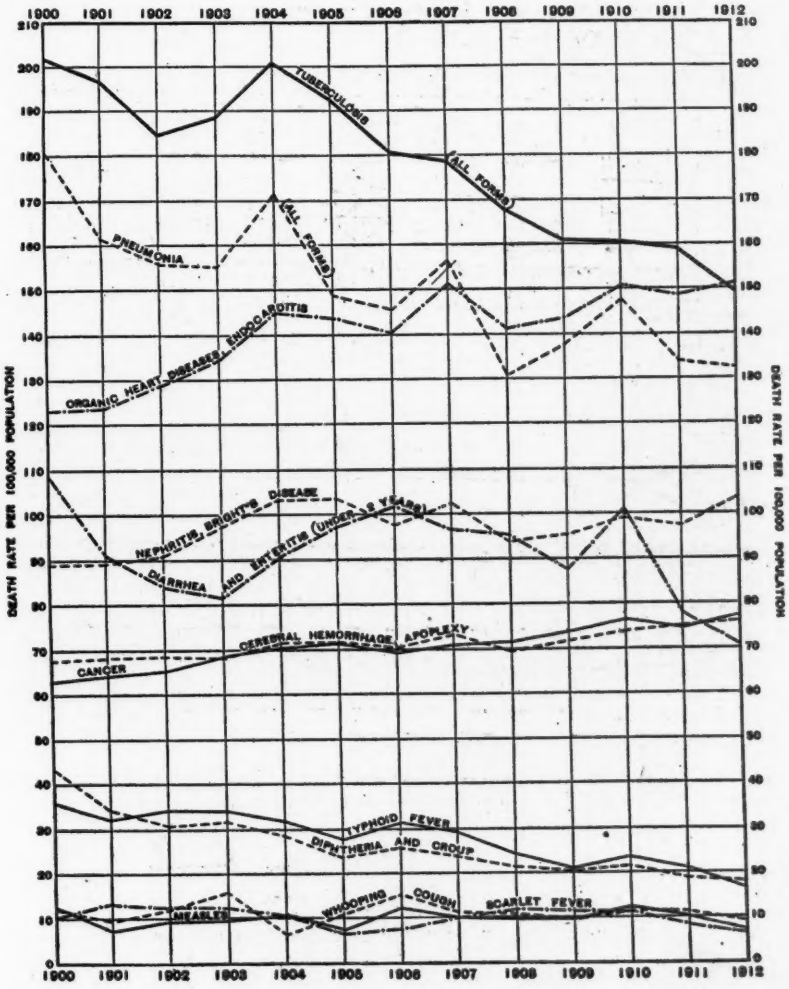
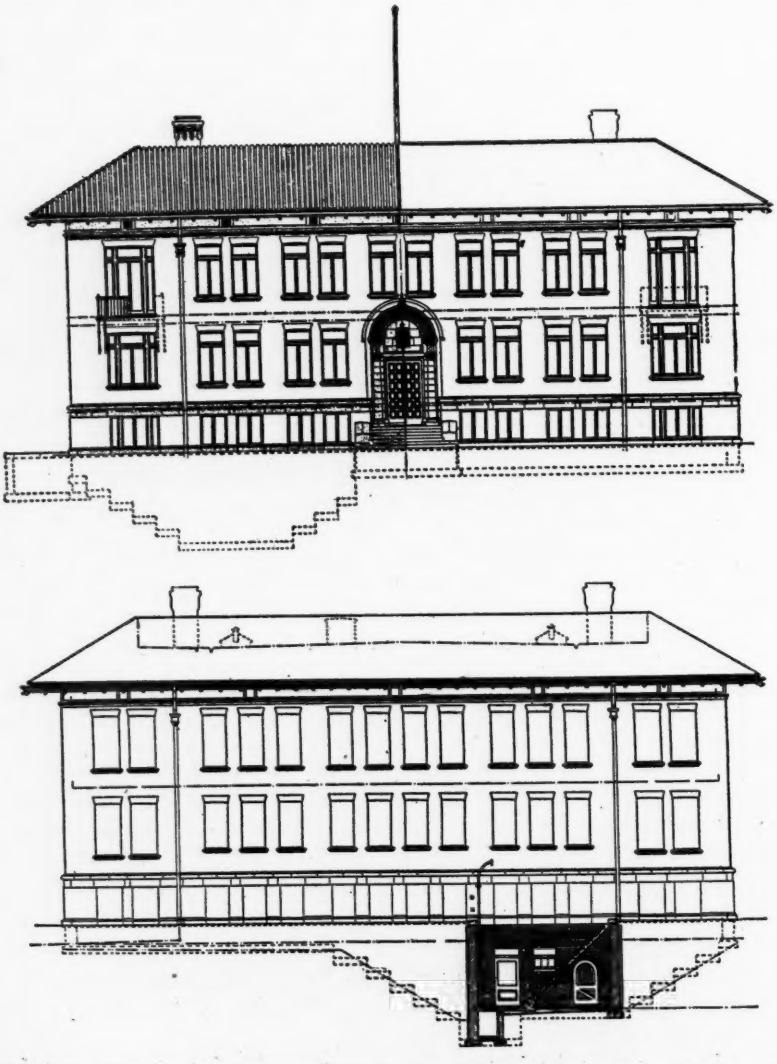
put a merely commercial valuation on the lives saved, it amounts to a billion dollars a year. It would surely be reasonable to spend the amount thus saved by better living conditions, improved hygiene and more efficient medical service to promote further advances in the same direction.

The death rate has declined in all the great nations, with the possible exception of Russia and Japan. Thus since 1886 the decrease in England has been about 6, in Germany about 9, in France about 3. These great differences for different nations are in large measure due to the age constitution of their populations. Thus England has doubled its population by natural increase in sixty years and Prussia in fifty years, but now the birth rate is rapidly declining. There is thus in their populations a small proportion of old people and a decreasing proportion of young children, which in large measure explains why the death rate is lower than in France where the population has been nearly stationary and there are nearly twice as many old people. The death rate for New York City in 1912 was 14.5, and for the entire state 15, but this does not mean that conditions are more favorable to health and to long

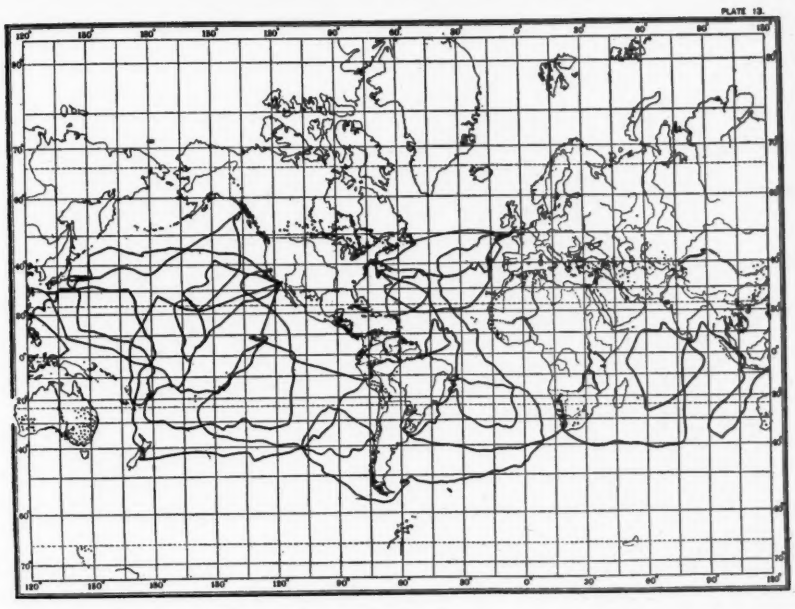


life in the city than in the country. The death rate in New York City is low because owing to emigration from abroad and the influx of young people from the country an unusually large percentage of the population is at the age when deaths are few.

In order to compare populations of different age and sex constitutions it is necessary to recalculate the rates for a standard population. Our Census Bureau has rather oddly chosen the population of England as the permanent basis of standardized rates. This population is about as abnormal as could be found, it having resulted from a large birth rate rapidly declining and a large emigration. For example, there is an excess of 1,200,000 women. There should be an international convention to fix a standard population, either a weighted average of the populations of the countries having adequate statistics, or an ideal population resulting,



FRONT AND REAR VIEWS OF THE BUILDING FOR THE DEPARTMENT OF TERRESTRIAL MAGNETISM.



THE MAGNETIC WORK OF THE DEPARTMENT OF TERRESTRIAL MAGNETISM, showing the ocean cruises and land stations.

say, from a birth rate of 20 and a death rate of 15.

The curves that are reproduced showing the death rates for each hundred thousand of the population from certain diseases can not be very accurate, as it is in many cases impossible to assign a single cause for death, and the returns of physicians are incorrect in a large percentage, perhaps in a majority, of cases. Still the curves are instructive, more especially in showing the decrease in certain contagious and preventable diseases, and the increase in certain organic diseases. In the short period of eleven years the rate for tuberculosis has decreased from 202 to 149; for infant diarrhœa, from 109 to 70; for typhoid fever, from 36 to 16; for diphtheria, from 43 to 18. On the other hand, the rate for heart disease has increased from 123 to 151; for apoplexy, from 67 to 75; for Bright's disease from 89 to 103, and for cancer, from 63 to 77.

It is evident that people must die some time and somehow; if they escape from the diseases prevalent in the earlier years of life, they must die from those of later life. It is also the case that the decreases noted are far greater than the increases. Still it is true that the decrease in the death rate is in the earlier age groups, while there has been an increase after the age of fifty-five. This has been attributed to the fact that the conditions of modern life are unfavorable to people of middle age. The fact seems to be, however, that the diseases from which people are likely to die in middle and old age are not to a considerable degree preventable, and the very fact that the lives of millions of infants and young people who were below the average in constitutional strength have been saved must lead to a higher death rate when they become more advanced in years.

THE WORK IN TERRESTRIAL MAGNETISM OF THE CARNEGIE INSTITUTION

AMONG the large mass of important scientific research conducted under the auspices of the Carnegie Institution of Washington and described in the annual

report of the president, that in terrestrial magnetism deserves special notice this year, in view of the fact that it is being provided with a permanent laboratory. As the director of the department, Dr. L. A. Bauer, points out, work on terrestrial magnetism and atmospheric electricity has been mainly observational. Magnetic and electric surveys have been extended to nearly all parts of the earth, and observatories have been conducted at a number of points at which are registered the variations to which the magnetic and electrical elements are subject with time and with varying planetary and solar conditions. But hitherto there has been no laboratory for the investigation of these phenomena of terrestrial and cosmical physics similar to the laboratories of astrophysics, to which are due such remarkable progress in that science.

The Carnegie Institution, which in the establishment of the solar observatory at Mount Wilson has contributed very greatly to the advance of astrophysics, has now undertaken to construct for its work in terrestrial magnetism the building of which views are here reproduced. It is being erected on a tract of land of about seven acres in Washington, about a mile north of the Bureau of Standards and the Geophysical Laboratory. The grounds are sufficiently removed from disturbing influences, so that the testing and comparisons of magnetic instruments and work in atmospheric electricity may be successfully carried on. The building, which is now nearly completed, consists of a basement, two stories, and an observation-roof, the size being 51 by 102 feet.

In addition to the work done in Washington, magnetic surveys of land areas have been made in various parts of the earth, including the Sahara Desert, Canada, west of Hudson Bay, northeastern South America and Australia. The accompanying map shows how extensive have been these surveys, including the two cruises of the non-magnetic ship *Carnegie*, which has now traversed a distance of about one hundred thousand miles, preceded by cruises of some sixty thousand miles by the chartered ship *Galilee*.

The Carnegie Institution has, in addition to this new laboratory and its administration building in Washington, erected buildings for its departments, each with their equipment, valued as follows: The Solar Observatory on Mount Wilson and at Pasadena, $754,000; the Geophysical Laboratory in Washington, $198,000; the Desert Laboratory at Tucson, Arizona, $48,000; the department of Experimental Evolution at Cold Spring Harbor, Long Island, $70,000; the Nutrition Laboratory, adjacent to the Harvard Medical School in Boston, $129,000, and the Department of Marine Biology at the Tortugas, $47,000. This last laboratory it is now proposed to remove to Jamaica.

SCIENTIFIC ITEMS

WE record with regret the death of Dr. Robert Kennedy Duncan, director of the Mellon Institute for Industrial Research in the University of Pittsburgh; of Professor William Whitman Bailey, professor emeritus of botany at Brown University; of Dr. Roswell Park, professor of surgery at the University of Buffalo; of Edward Singleton Holden, librarian of the U. S. Military Academy, formerly director of the Lick Observatory; of Dr. Albert Gunther, late keeper of zoology in the British Museum, and of Sir John Murray, the distinguished oceanographer.

SIR FRANCIS DARWIN delivered the first Galton anniversary lecture on February 16 in London. The subject of the lecture was Francis Galton—Professor R. W. Wood, of the Johns Hopkins University, gave in London, on February 27, the first Guthrie lecture of the Physical Society, his subject being "Radiation of Gas Molecules Excited by Light."